apple service

LEVEL I
TECHNICAL PROCEDURES
#072-0062
VOLUME II

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Level 1

Technical Procedures

Volume II

#072-0062

Revision: September 1984

TECHNICAL PROCEDURES MANUAL

January, 1986 Edition

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Silentype

TECHNICAL PROCEDURES MANUAL

February, 1986 Edition

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SILENTYPE PRINTER TECHNICAL PROCEDURES

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Silentype Technical Procedures

Section 1

Take-apart

Contents:

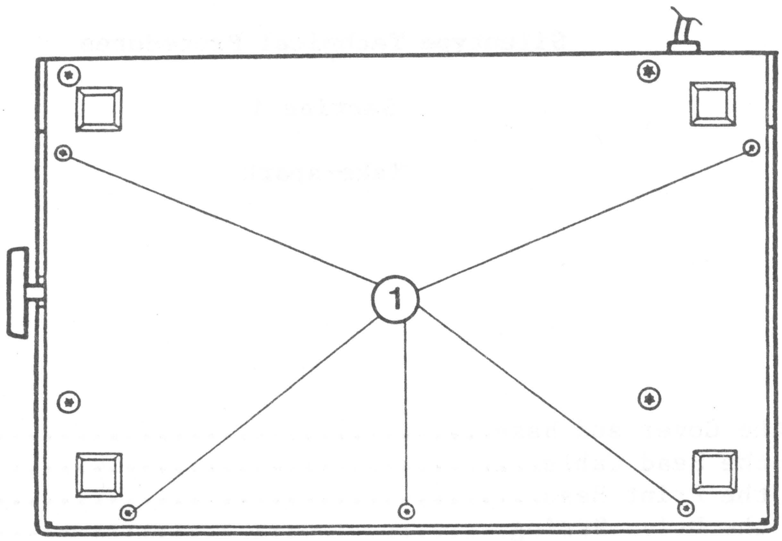


FIGURE 1

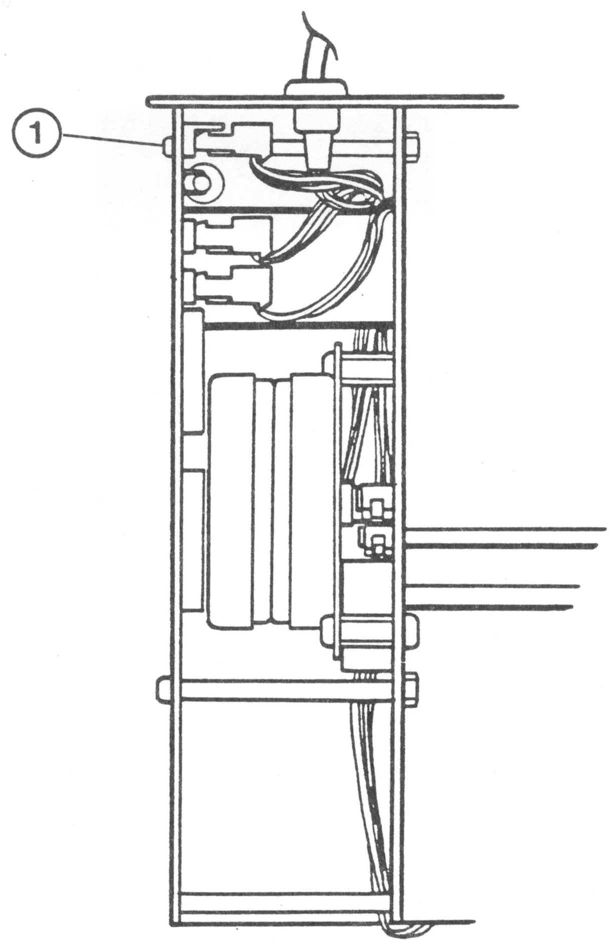


FIGURE 2

A. REMOVING THE COVER AND BASE

Removing the Cover

1. Turn the Apple off.

2. Disconnect the printer from the interface card.

3. Tip the unit up on its back.

   NOTE: Do not turn the Silentype completely over. The paper roll is held in by gravity.

4. Using a Torx screwdriver, remove the five screws around the outside of the base which hold the plastic cover on (see Figure 1).

5. Remove the cover.

Removing the Base

6. While holding the chassis to the base, remove the remaining four screws.

   NOTE: In general, it is a good idea to remove all nine screws every time you begin to service a Silentype, since you will nearly always have to get underneath the assembly.

7. Tip the unit back down. At the left of the unit is a printed circuit board (the deserializer card). Locate the three cables connected to it, and disconnect the rearmost cable (interface cable) from connector J3 (see Figure 2, #1). The chassis can now be lifted from the base.

apple computer

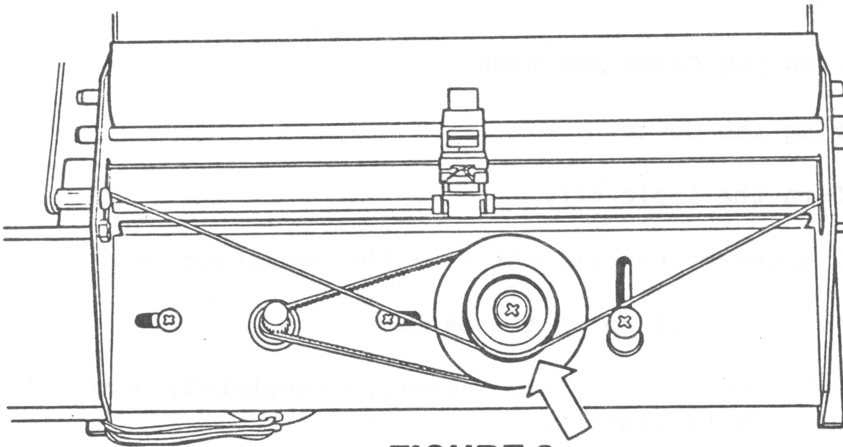


FIGURE 3

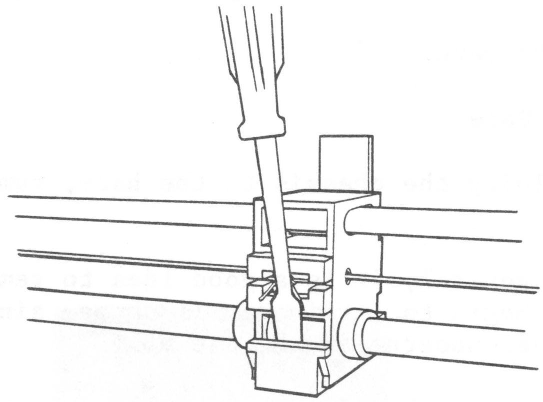


FIGURE 4

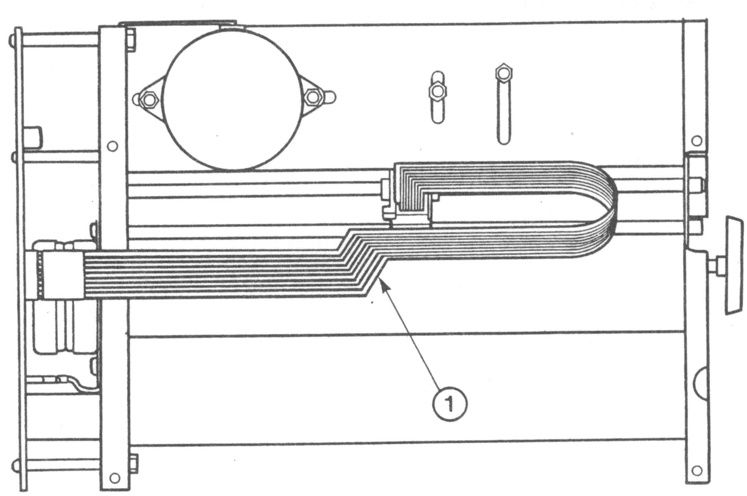


FIGURE 5

B. REPLACING THE HEAD CABLE

Removing the Cable

1. Remove the Silentype cover and base (see section A, p. 1.3).

2. Rotate the pulley (Figure 3) until the print head is in the center of the platen.

3. Using a small screwdriver, pry the cable clip away from the head carrier, forward and down (Figure 4). The cable will fall away from the head assembly.

4. Tip the chassis up so the underside faces you.

5. If the head cable is taped to the chassis, untape it.

6. Unplug the cable from the deserializer card.

7. Pull the cable clip off the other end of the cable. (Don't worry, it does come off.)

Installing the Cable

8. Hold the new cable up so the change of direction goes upward (Figure 5, #1), and carefully plug it to the deserializer card.

   IMPORTANT: THE HEAD CABLE IS EASILY DAMAGED. PERFORM THE NEXT STEPS CAREFULLY AND GENTLY. In particular, make sure the cable is fully inserted into the cable clip before connecting the clip to the print head assembly; otherwise you may crimp and crack it.

9. Plug the other end to the cable clip, making sure the small rubber pad is in place between the cable connections and the clip.

10. Bend the cable without twisting, and clip it to the print head assembly (Figure 5).

11. Make certain the cable crosses the left side of the chassis at a right angle, and secure it to the left rail with cellophane tape.

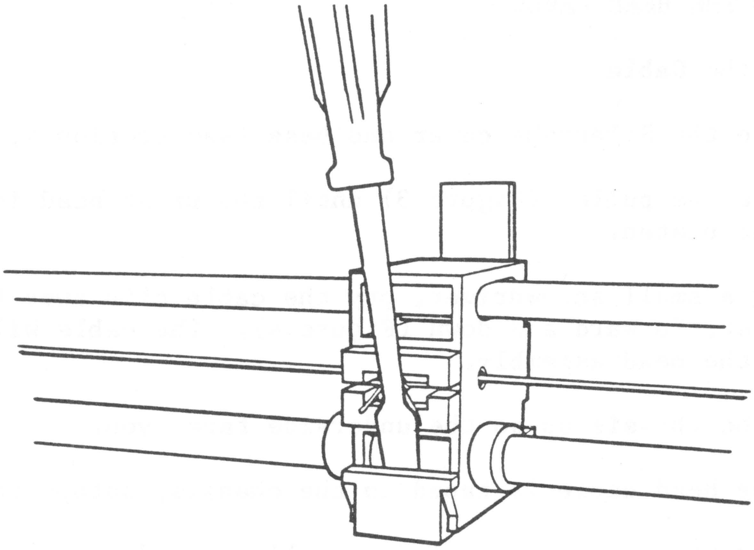


FIGURE 6

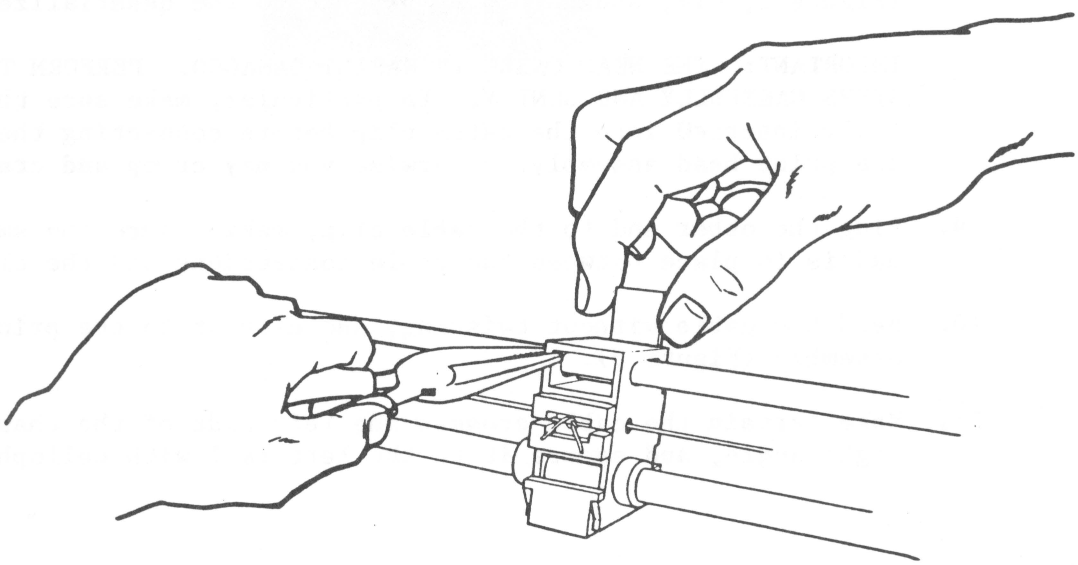


FIGURE 7

C. REPLACING THE PRINT HEAD

Removing the Print Head

1. Remove the Silentype cover and base (see section A, p. 1.3)

2. Pry the cable clip off the print head carrier, forward and down (Fig.6). The cable will fall away from the head assembly.

3. Using needlenose pliers, gently pull the head carrier toward the front of the printer (see Figure 7).

   CAUTION: THE CERAMIC HEAD IS BRITTLE. THAT MEANS IT CAN SHATTER. IT ALSO CAN BE SHARP ENOUGH TO CUT FINGERS. USE CARE WITH THE NEXT OPERATION!

4. With your fingers, pull the head upward -- carefully -- sliding it out of the head carrier (see Figure 7). If you can't pull the head out with your fingers, stand the chassis on end and carefully push the head out of the carrier with a screwdriver.

INSTALLING THE PRINT HEAD

NOTE: The plastic bar that supports the paper is called the platen. It should not be necessary to remove it, but it sometimes falls out, and it is important to replace it SQUARE EDGE UP. Otherwise the print head will short out and ruin the Silentype.

5. Make sure the platen is properly seated and gently pushed back, then slide the new head in with the edge connector on the bottom and the white side facing you.

6. Push the head gently down until it is seated against the plastic stop. If it becomes caught, tilt the chassis up (to see what the problem is) and help it along. Be careful not to shear off the plastic stop at the bottom of the head carrier.

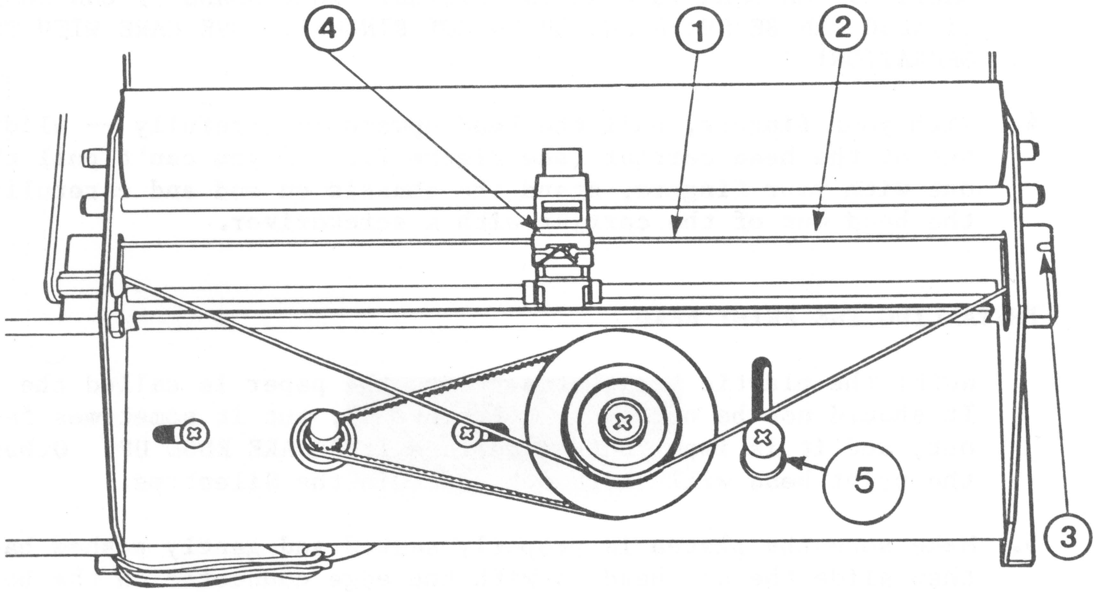


FIGURE 8

D. REPLACING THE DRIVE STRING

1. Remove the Silentype cover and base (see section A, p. 1.3).

2. Turn the pulley until the print head is in the middle of the platen.

3. Hold the pulley from beneath with a pair of pliers, and with a screwdriver, loosen the screw.

4. Push the pulley toward the printer, taking the tension off the string; then, with the pulley pushed toward the printer, tighten it back down.

   IMPORTANT: If the pulley is too close to the printer, it will bind. Make sure it can turn freely when you tighten it down.

5. Hold the idler (Figure 8, #5) from beneath with a pair of pliers, and with a screwdriver, loosen the screw and move the idler towards you. The idler screw can be left loose for right now.

6. Unwind the string from the pulley.

7. Cut the old string on the right side of the print head (Figure 8, #1).

8. Tie a new string (precut to approximately 40") to the right hand portion of the old string (Figure 8, #2).

9. Pull on the old string on the left side of the print head, until the new string is threaded through the right guide (Figure 8, #3), across the front, and through the left guide.

10. Cut the knot out completely.

11. Pry the retainer (Figure 8, #4) out of the head assembly, and discard the old string.

12. Thread the new string into the small holes from the outside of both sides of the head assembly, and tie a loose knot.

13. Pull the knot straight back until the string is taut.

14. Pull the front part of the string toward you about 14 inches; then take the portion of string coming out of the left guide and, starting at the bottom front of the pulley, wrap six turns counterclockwise around the pulley.

    IMPORTANT: Make sure the loops of string do not overlap; if they do, you will have alignment problems.

15. Grasp the knot and pull until the string is snug.

16. Slip the retainer in place in the print head assembly.

17. Holding the string snug, cut out the old square knot and start a new one.

    NOTE: Make sure the string runs **between** the idler and the paper.

18. Tighten it, finish the square knot, and cut away the excess string.

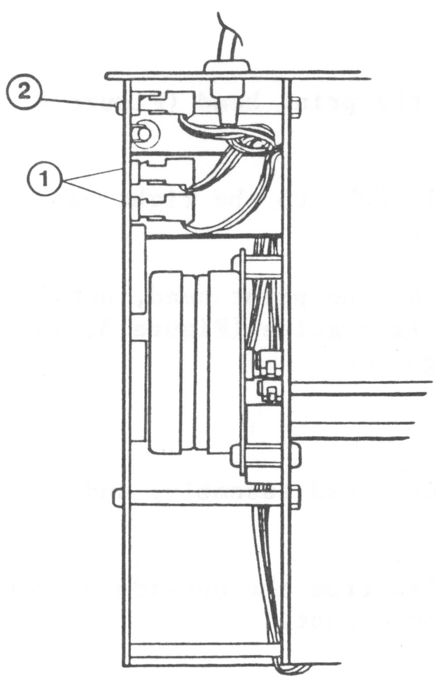


FIGURE 9

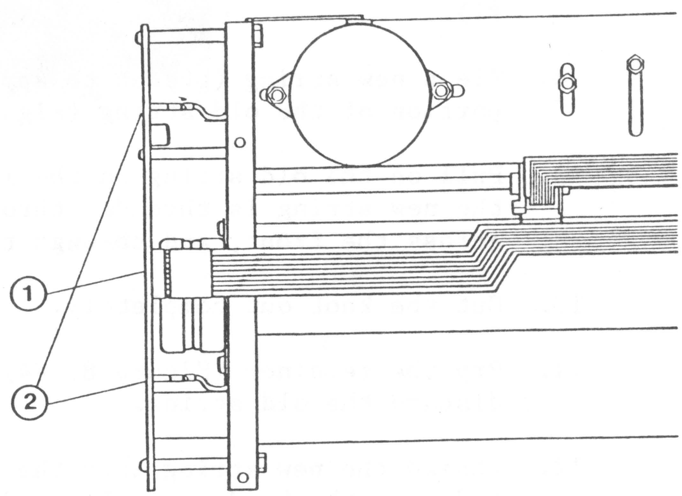


FIGURE 10

E. REPLACING THE DESERIALIZER CARD

Removing the Card

1. Remove the Silentype cover and base (see section A).

2. Locate the two motor plugs (Figure 9, #1). Put a piece of tape on the frontmost plug, to identify it.

3. Remove the two motor plugs.

4. Turn the chassis up and disconnect the print head cable (Figure 10, #1).

5. Disconnect the left margin switch connector (Figure 10, #2).

   NOTE: On the EMI version of Silentype, the left margin switch consists of two wires, as shown in Figure 10. Earlier Silentypes have only one wire (the rear one).

6. Remove the three screws holding the deserializer card to the chassis.

   IMPORTANT: BEFORE REPLACING THE DESERIALIZER CARD, MAKE SURE THAT THE NEW CARD IS EMI-COMPATIBLE WITH THE CHASSIS. SEE SECTION 5, SILENTYPE MODIFICATIONS.

Installing the Card

7. Put the card into position, taking care not to capture any wires behind the capacitor, and thread the bottom screw through the spacer and nut until it is "finger-tight".

8. Put in the other two screws. After checking to make sure no wires are caught beneath the spacers, tighten the three screws.

9. If you're working on a non-EMI Silentype, make sure that the bottom screw is tight enough to make good electrical contact. (It is part of the electrical continuity that forms the ground.)

10. Connect the left margin switch wire(s) and the print head cable.

11. Tip the chassis back down. Plug in the motor plugs (on each, the orange wire connects to the top pin) and the interface cable (Figure 9, #1 and 2). Remove the tape from the frontmost plug.

12. Reinstall the base and cover. Make sure all screws are tight.

    NOTE: Do not apply power while the printer assembly is loose in the base; it may cause a short circuit between the base and the deserializer card.

apple computer

Silentype Technical Procedures

Section 2

Alignment Procedures

Contents:

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A. Silentype Alignment Procedures

Whenever you change the string on a Silentype, or when a customer complains that the print margins are misaligned, perform the following procedures.

1. Using a known-good Apple][system, make sure the power is off, then plug the Silentype interface card into Slot 1 on the motherboard. Make sure the card is properly seated, and then turn the power on.

2. Place the Apple][Product Diagnostics diskette (P/N 652-0334) in drive 1. Boot the diagnostic and select CARD TESTS from the main menu; then select SILENTYPE TEST from the secondary menu.

3. Accept "Align print head" when that option comes up on the screen. The program will cause the Silentype to print rows of capital H's until you stop it by pressing Y. The rows of H's will allow you to see if there is any misalignment. If there is serious misalignment (more than one dot to the left or right), continue with these procedures.

4. **Check the drive string where it winds around the pulley.** If the loops of string are uneven, overlapping each other, the string tension will be uneven and that will cause misalignment. If necessary, loosen the pulley and re-wrap the string around it so that the loops of string do not overlap.

5. **Check the tension on the drive string.** It should be just tight enough so that it does not slip on the pulley. To adjust it coarsely, loosen the pulley screw and move the pulley to the desired position; then tighten the screw.

6. **Check the tension on the motor belt** (between the motor and the pulley): it should be just tight enough to prevent slipping. Overtightening causes the print head to move unevenly, which makes alignment difficult. (It also causes wear on the bearings.) If necessary, loosen the two motor mounting screws very slightly (the adjustment is easiest if they are slightly tight) and move the motor. Start with a snug but not stretched belt. Print a pair of lines and notice any misalignment. Move the motor slightly to the right and observe the printing of a pair of lines. Repeat until alignment is as good as you can make it; then tighten the motor screws.

7. While the "H's" are printing, **change the position of the idler roller** by loosening the idler screw and moving the idler. This fine-tunes the tension on the string. When alignment is as good as you can make it, tighten the idler screw.

apple computer

Silentype Technical Procedures

Section 3

Diagnostics

Contents:

INTRODUCTION

This diagnostic is found on the Apple][Products Diagnostics diskette (Part Number 686-0005) under the main menu selection of CARD TESTS.

A. ALIGNING THE SILENTYPE PRINTER MECHANISM

1. This test would be run whenever the print quality of the Silentype is poor or the print head does not move smoothly from one margin to the other.

2. To run the test:

   a. Install the Silentype Interface card in slot 1 and connect the Silentype to it.

   b. Boot the Apple][Product Diagnostics diskette.

   c. Use the <ESC> key to move the cursor to the CARD TESTS line on the main menu, then press <RETURN>.

   d. Use the <ESC> key to move the cursor to the SILENTYPE TEST line on the card test menu, then press <RETURN>.

   e. Type in "Y" and then press <RETURN> to the prompt:

      DO YOU WISH TO ALIGN THE PRINT HEAD
      DRIVE MECHANICS AT THIS TIME?

   f. The Silentype will start to printing H's from the left to right margin then reverse direction and print H's from the right to the left margin.

      (1) You can suspend the printing at any time by pressing "Y" to the prompt:

          DO YOU WISH TO SUSPEND PRINTING?

      (2) You can then exit the test by pressing "N" to the prompt:

          DO YOU WISH TO RESUME PRINTING PATTERN?

          (a) If you answer yes by pressing "Y", the test will resume printing H's.

   g. Observe the quality of the printed characters on the paper for:

      (1) Bidirectional Printing

          (a) If the left and right margins are not even, adjust the Dacron Cord.

(2) That the Print Head moves evenly from one margin to the other.

(a) If the Print Head movement is uneven, adjust the Drive Motor belt tension.

(3) For all other print quality problems, refer to the Silentype Troubleshooting - Section 4.

B. OTHER TESTS

1. The Remaining tests on the Apple][Product Diagnostics are for testing the carriage and paper drives, printing and variable intensity circuits, and bi-directional print function.

2. To run the tests:

a. Install the Silentype Interface card in slot 1 and connect the Silentype to it.

b. Boot the Apple][Product Diagnostics diskette.

c. Use the <ESC> key to move the cursor to the CARD TESTS line on the main menu, then press <RETURN>.

d. Use the <ESC> key to move the cursor to the SILENTYPE TEST line on the card test menu, then press <RETURN>.

e. Type in "N" and then press <RETURN> to the prompt:

DO YOU WISH TO ALIGN THE PRINT HEAD
DRIVE MECHANICS AT THIS TIME?

3. Firmware Test

The Firmware test will check the ROMS on the Silentype Interface Card and report their condition to you.

4. RAM Test

The Ram test will check the RAM on the Silentype Interface Card and report their condition to you.

5. Margin Switch

This test will check the status of the left margin switch and report to you it's condition.

6. Head Movement

   This test will make the print head move back and forth. Observe that the Print Head moves smoothly in both direction.

7. Line Feed

   This test will send a line feed character to the Silentype. Observe that the paper exits squarely and that there are no wrinkles or creases caused by the paper feed mechanism.

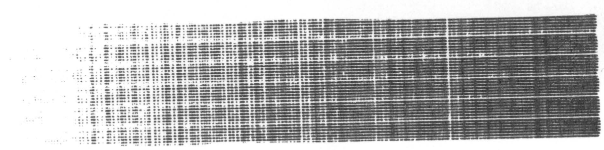
8. Print Head Dot Integrity

   This test will print a series of lines on the printer paper, each one representing one of the seven dots on the Print Head. Below is an example from a good Silentype Printer:



9. Print Intensity Control Test

   This test prints out 6 lines on the printer paper which vary in eight degrees of intensity. Below is an example from a good Silentype Printer:



10. Bidirectional Print Registration

    This test prints parallel vertical lines to verify the Bidirectional Print Adjustment. The tolerance is +/- one dot.

```
  * *          * *          * *
  * *          * *          * *
  * *          * *          * *

  * *         * *         * *
  * *         * *         * *
  * *         * *         * *
 Perfect       Good      Unacceptable
```

Silentype Technical Procedures

Section 4

Troubleshooting

NOTE: The Silentype printer should be tested with the Apple II Peripherals Diskette. (See **Multi-Product Diagnostics Technical Procedures, Section 1.**)

Silentype Troubleshooting Chart

Symptom	Probable Cause
Some dots are not printing.	1) Head Cable 2) Print Head 3) Deserializer Card
One or more dots print continuously.	1) Deserializer Card
Silentype prints wrong characters.	1) Deserializer Card
No print head movement or movement is erratic.	1) Belt Tension Adjustment
Print intensity test fails.	1) Deserializer Card
Silentype will not print bidirectionally.	1) Cord Tension Adjustment
Silentype prints unreadable or no characters; print head moves.	1) Print Head 2) Platen Assembly 3) Deserializer Card
Paper does not advance properly.	1) Paper Bearing Assembly 2) Deserializer Card 3) Paper drive motor

NOTE: If the troubleshooting actions listed above do not repair the problem, send the Silentype unit back to Apple for repair.

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Silentype Troubleshooting Chart

Symptom	Probable Cause
Some dots are not printing.	1) Head Cable 2) Print Head 3) Deserializer Card
One or more dots print continuously.	1) Deserializer Card
Silentype prints wrong characters.	1) Deserializer Card
No print head movement or movement is erratic.	1) Belt Tension adjustment
Print intensity test failure from Apple][products diagnostics.	1) Deserializer Card
Bidirectional print test failure from Apple][products diagnostics.	1) Cord tension Adjustment.
Silentype prints unreadable or no characters; Print Head moves.	1) Print Head 2) Platen Assembly 3) Deserializer Card
Paper does not advance properly.	1) Paper Bearing Assembly 2) Deserializer Card 3) Paper drive motor

NOTE: If the symptom is not repaired by the above list, send the silentype unit back to an Apple][Level II Service Center for repair.

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Silentype Technical Procedures

Section 5

Modifications

Contents:

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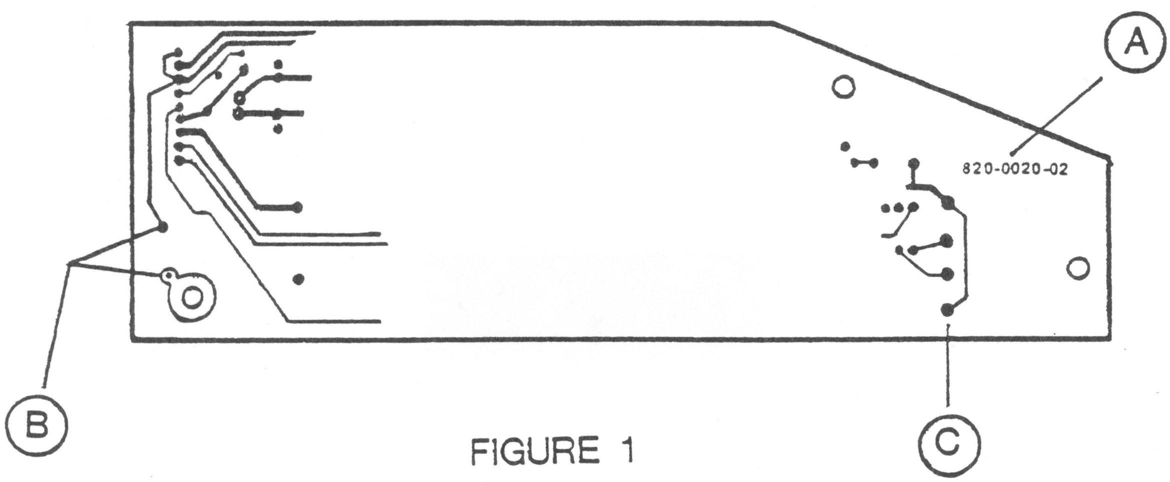


FIGURE 1

A. EMI MODIFICATIONS TO THE SILENTYPE

Like the Apple II, the Silentype has been modified to reduce the electromagnetic (radio frequency) interference produced by early models. The new versions are called EMI (or RFI) Silentypes.

Only the EMI chassis and deserializer card are now produced and available from Apple, but there are plenty of early-model Silentypes in the field. If you have to swap out the deserializer card on an old, non-EMI Silentype, you will have to replace it with an EMI card; but unless you modify it, the new card will cause the old chassis to print with an uneven left margin. Therefore you need to know how to identify the two types of chassis and deserializer card, and how to modify the EMI card to work with a non-EMI chassis.

1. IDENTIFICATION

The Chassis

The EMI Silentype chassis has a two-wire left margin switch connector where the earlier Silentype has a single-wire connector. They are also distinguishable by model number: the earlier version has model number A2M0032, the EMI version has model number A2M0036. The model number is printed on the label on the back of the case.

To summarize:

Non-EMI	EMI
Model # A2M0032	Model # A2M0036
One-wire left margin switch	Two-wire left margin switch

The Deserializer Card

The EMI card has part number 820-0020-02 printed on the trace side (see Figure 1, A). It has an additional terminal pin (J6) (Figure 1, C) for the extra EMI left margin wire switch.

The non-EMI card bears part number 820-0020-01. It has a single terminal pin (labelled J5) for the left margin switch wire.

More information on the differences between the EMI and non-EMI versions of Silentype can be found in Apple Service Bulletin #39.

TURN PAGE

2. MODIFYING THE EMI CARD

To modify the EMI card for use with a non-EMI chassis, you must solder a jumper wire across two solder pads provided on the card for that purpose (see Figure 1, B). Follow the procedure below:

1. Find the two solder pads on the deserializer card (Figure 1, B). If the holes are filled with solder, open them using a soldering iron and solder sucker.

2. Take a one-inch piece of 20- to 24-gauge insulated wire. Remove approximately 1/4 inch of insulation from each end of the wire.

3. Insert one end of the jumper through the hole in one of the solder pads (from the trace side of the board). Solder it into place. Do the same for the other end and the other solder pad.

4. Snip off any excess jumper wire that may protrude on the other side of the card.

5. Install the deserializer card in the printer as usual. Note that the left margin switch wire from the chassis should connect to post J5 on the card and that J6 (Figure 1, C) will not be used.

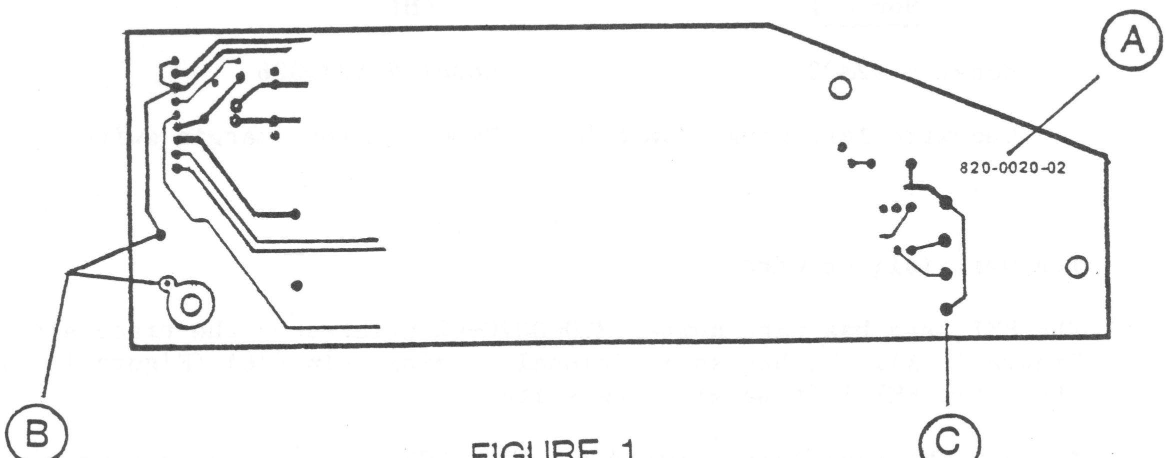


FIGURE 1

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Silentype Printer Technical Procedures

Section 6

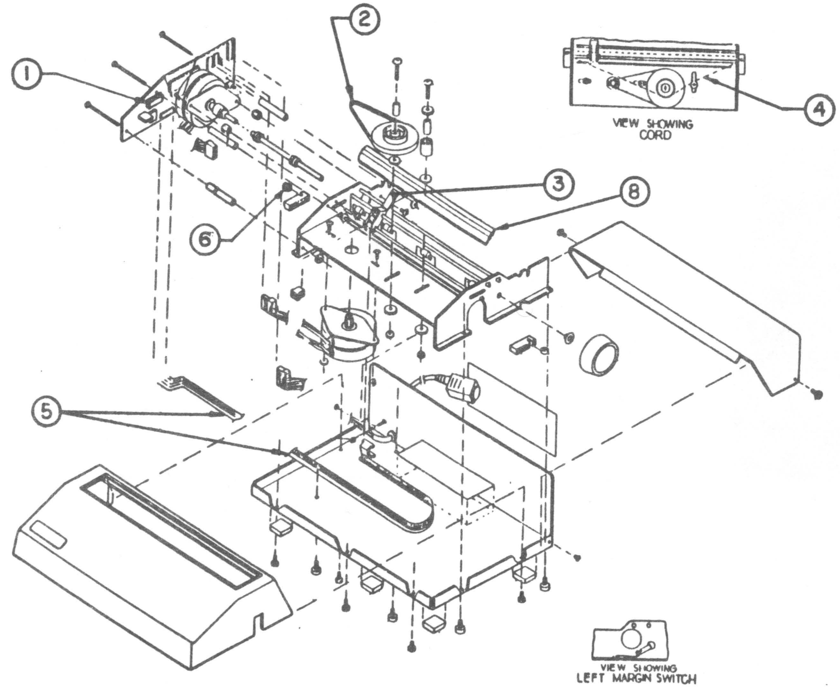
Illustrated Parts List

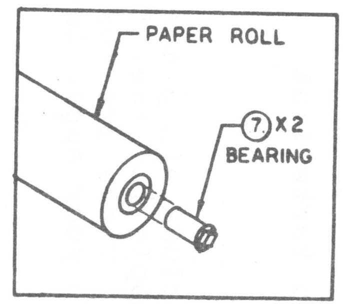
The figures and lists below include all piece parts that can be purchased separately from Apple for the Silentype Printer, along with their part numbers. These are the only parts available from Apple. Refer to your Apple Service Programs manual for prices.

Contents:

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A		5493	INITIAL RELEASE		

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SIZE B DRAWING NUMBER 070-0198 -A SHT 1/2

DRAWING NUMBER 070-0198-A SHT 1/2

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SILENTYPE PRINTER (Figure 1)

Item	Part No.	Description
1	305-0000	IC 74LS00N
2	970-0443	Head Drive Belt
3	970-0418	Print Head, Silentype
4	970-0442	Dacron Cord
5	970-0401	Head Cable
6	970-0410	Cord Pulley
7	970-0406	Paper Bearing Assembly
8	970-0402	Silentype Platen

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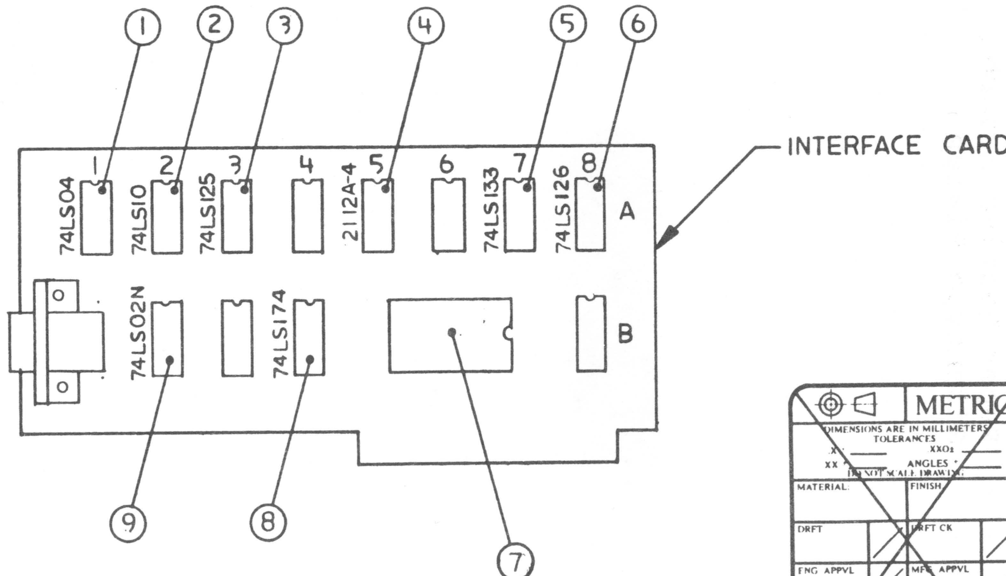


Figure 2

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SILENTYPE PRINTER (Figure 2)

Item	Part No.	Description
1	306-0004	IC 74LS04
2	306-0010	IC 74LS10
3	306-0125	IC 74LS125
4	334-2112	RAM 256x4 2112A-4
5	306-0133	IC 74LS133
6	306-0126	IC 74LS126
7	342-0039	ROM Silentype Control
8	306-0174	IC 74LS174
9	306-0002	IC 74LS02N

Dot Matrix Printer

apple computer

DOT MATRIX PRINTER TECHNICAL PROCEDURES

TABLE OF CONTENTS

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Dot Matrix Printer Technical Procedures

Section 1

Introduction

Contents:

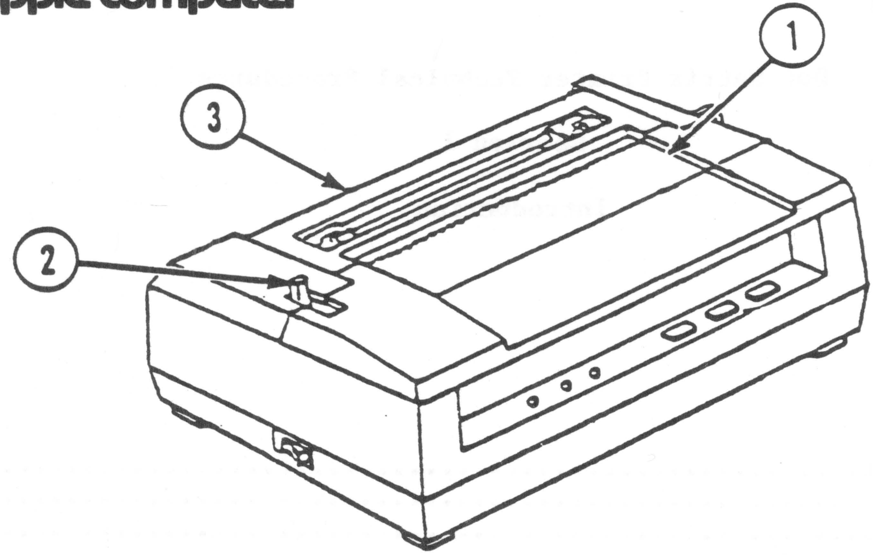


FIGURE 1

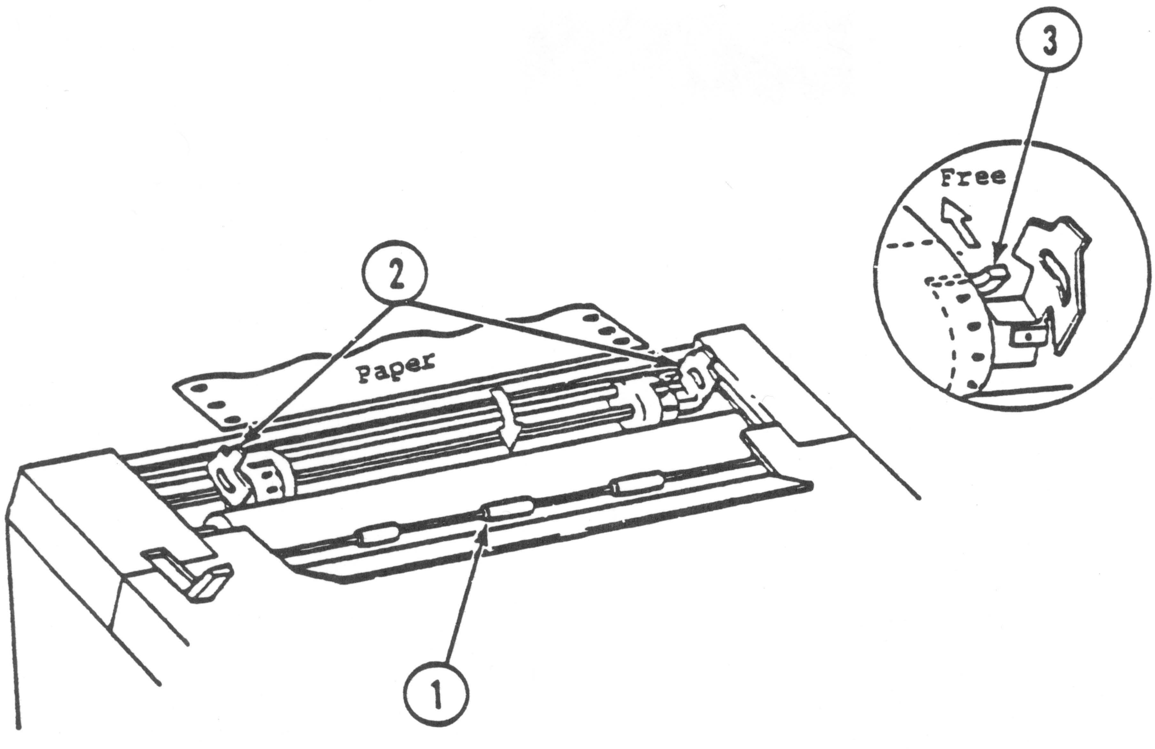


FIGURE 2

A. POWER ON AND OFF, LOAD AND REMOVE PAPER AND RIBBON CASSETTE, AND RUN SELF-TEST

Power on and off

1. Plug the power cable into the back of the printer.
2. Plug the power cable into an electrical outlet.
3. Flip the power switch to ON.
4. Check the front panel. Make sure the POWER light comes on.
5. Flip the power switch to OFF.

Load paper

1. Make sure the power is off.
2. Raise the paper cutter toward you. (See Figure 1, #1.)
3. Pull the paper release level forward. (See Figure 1, #2.)
4. Remove the paper cover. (See Figure 1, #3.)
5. Pull the paper roller shaft forward. (See Figure 2, #1.)
6. Lift the covers off the right and left tractor sprockets. (See Figure 2, #2.)
7. Make sure the left tractor is all the way over to the left. To adjust the tractor, push back the white lever. (See Figure 2, #3.) Move the tractor all the way over to the left. To lock the tractor in place, pull the white lever back toward you.

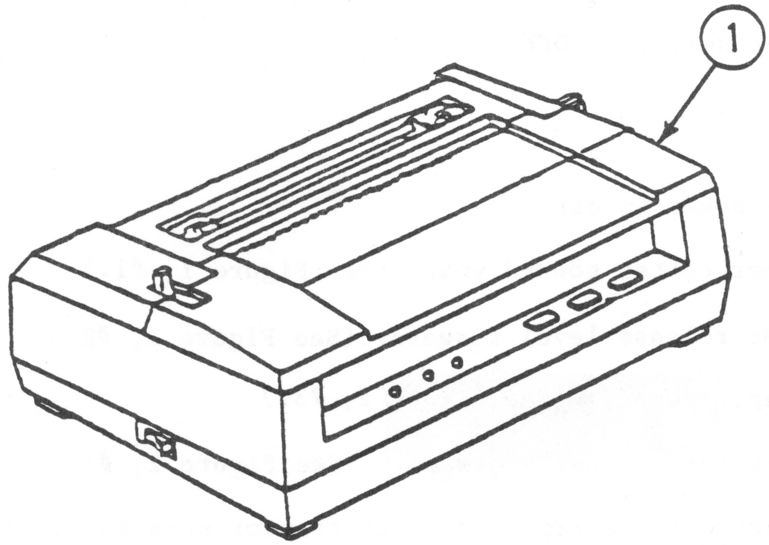


FIGURE 3

8. Insert the paper over sprockets. If the paper doesn't line up with the sprockets, adjust the right tractor until it does.

9. Push down the covers on right and left tractor sprockets.

10. Turn the platen knob until the paper comes through.

11. Push back the roller shaft.

12. Push back the release lever.

13. Put the paper cover back on.

14. Push back the paper cutter.

Remove Paper

1. Make sure the power is off.

2. Pull the paper cutter toward you.

3. Remove the paper cover.

4. Pull the release lever forward.

5. Turn the platen knob to back out the paper.

Remove Ribbon Cassette

1. Make sure power is off.

2. Remove the carrier cover. (See Figure 3, #1.)

3. While pushing down on the cassette latch arms, lift up the cassette.

4. Replace the carrier cover.

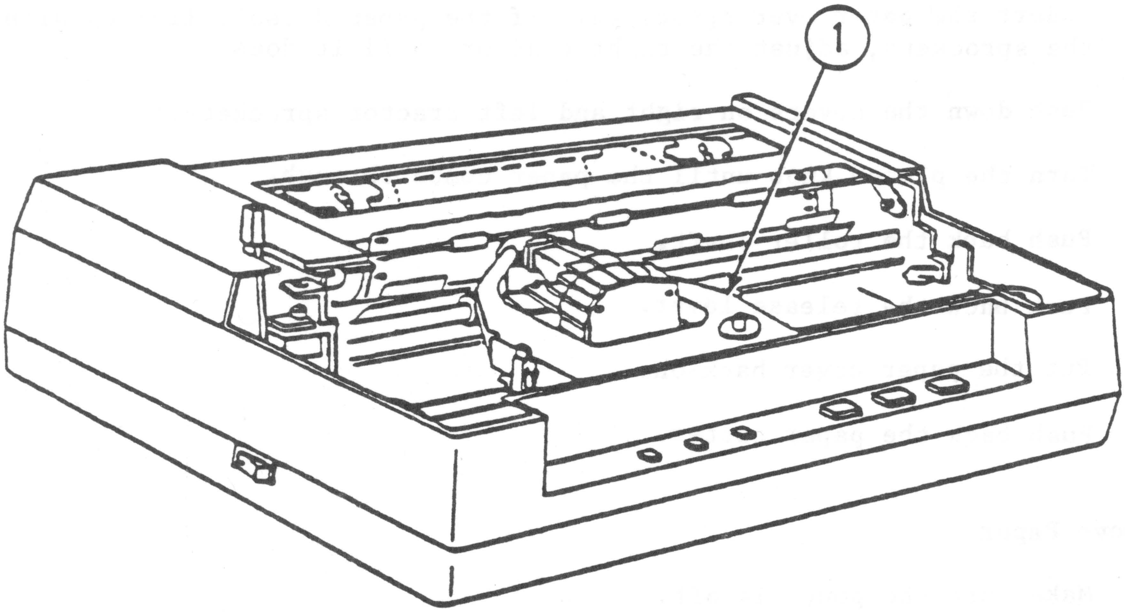


FIGURE 4

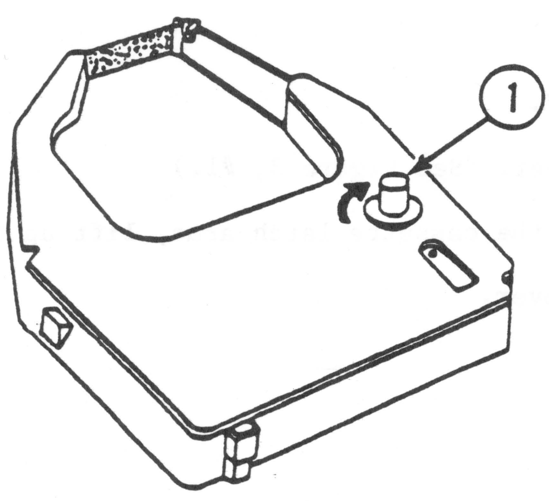


FIGURE 5

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Load Ribbon Cassette

1. Make sure the power is off.
2. Remove the carrier cover.
3. Get a ribbon cassette.
4. Put the cassette on the ribbon support plate.
5. Push down on the cassette until it snaps in place. (See Figure 4, #1.)
6. On the cassette, turn the knob as shown until you hear it "click" and the ribbon is taut. (See Figure 5, #1.)
7. Replace the carrier cover.

Run Self-test

NOTE: When you run the self-test, you should always use a brand new ribbon and a single sheet of paper. Before you begin the test, push up the red head adjusting lever on the right side of the printer.

1. Make sure the power is off.
2. Load the paper. Make sure the paper is secure under the roller shaft.
3. To run self-test, press and hold the T.O.F. switch on the front panel, then switch the power on. The printer will then start printing out lines of characters. Each line contains the letters of the alphabet, the numbers 0 through 9, and a series of typographical characters.
4. To end the test, set the power switch to OFF.

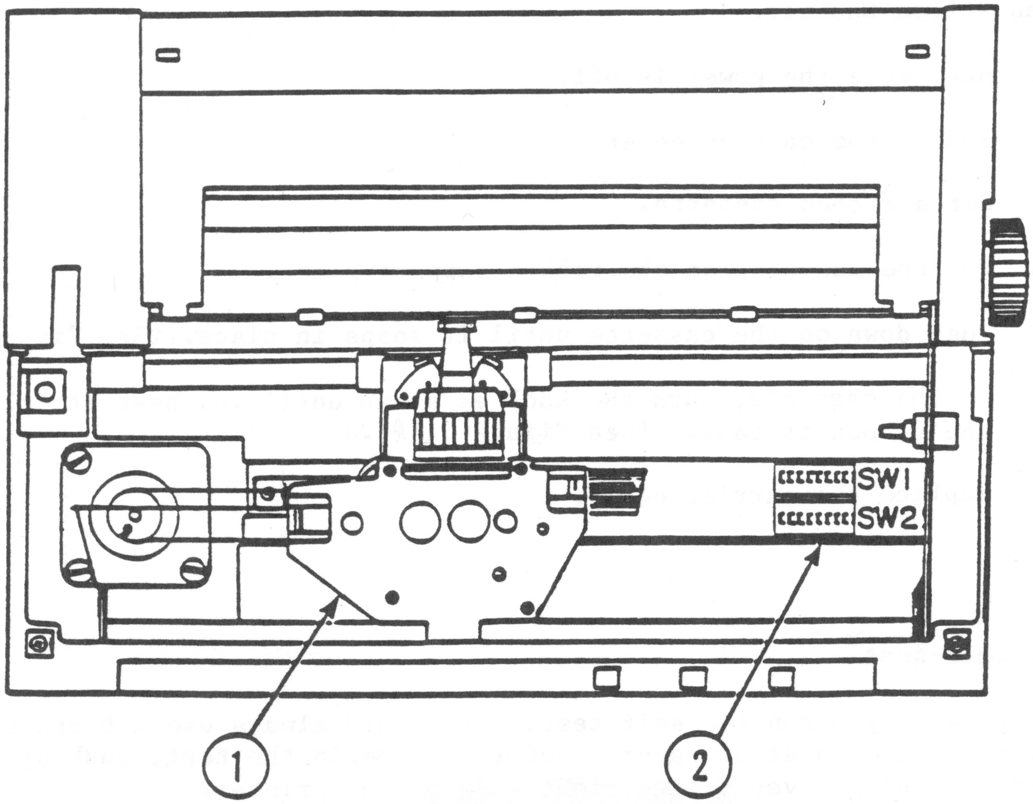


FIGURE 6

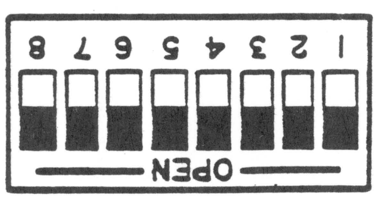


FIGURE 7

B. **SET CONFIGURATION SWITCHES**

For this procedure you will need:

A tiny flat blade screwdriver

1. Make sure the power is off.
2. Remove the paper and the carrier cover.
3. Slide the carrier all the way to the left. (See Figure 6, #1.)
4. Locate switches SW 1 and SW 2. (See Figure 6, #2.)
5. Pull the plastic strip out of the way.
6. Using a small screwdriver, set all the SW 1 switches to OPEN. (See Figure 7.)
7. Using the chart on the next page, set all SW 1 switches to their normal setting.

		SW 1 SWITCH SETTINGS
SWITCH	NORMAL SETTING	PURPOSE
1 2 3	OPEN CLOSED OPEN	Switches 1-3 select which set of national characters will be printed. If you set the switches to OPEN, CLOSED, OPEN, the printer will print United States characters.
4	OPEN	Switch 4 selects paper length. Set the switch to OPEN for paper that is 11 inches long. (66 lines)
5	OPEN	Switch 5 determines if a host computer can put the printer on-line and off-line. If you set the switch to OPEN, the host computer will have this capability.
6	OPEN	The computer sends characters to the printer. Sometimes the printer stores these characters without receiving a command to print them. When the printer's memory is full, it can do one of two things when it receives a print command. 1) It can go to a new line on the page and begin printing. 2) It can print from wherever the print head is at the time the print command is received. Normally, you want the printer to start where it left off, so set switch 6 to OPEN.
7	CLOSED	The computer tells the printer to start printing by sending a print command. There are a number of print commands. They include Carriage Return, Linefeed, Vertical Tab, and Formfeed characters. Normally, you want any of these characters to start printing. So set Switch 7 to CLOSED. If Switch 7 is set to OPEN, only a Carriage Return character will start printing.
8	OPEN	If the host computer sends a Linefeed following the Carriage Return, set switch to OPEN. If host does not send the Linefeed, the printer will add a Linefeed when switch is CLOSED.

8. When you finish setting the switches, make sure SW 1 looks like this:

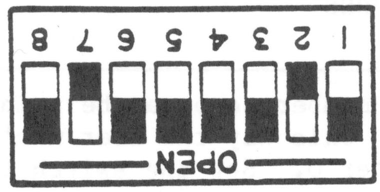


FIGURE 8

9. Using a small screwdriver, set all SW 2 switches to OPEN.

10. Using the chart on the next page, set all SW 2 switches to their normal setting.

		SW 2 SWITCH SETTINGS
SWITCH	NORMAL SETTING	PURPOSE
1	CLOSED	The number zero can be printed with a slash through it. This way the user won't confuse it with the letter O. Set the switch to CLOSED to print slashed zeroes.
2	OPEN	This switch determines the size of the printer's memory. To get the largest memory possible, set this switch to OPEN. CLOSED is only 1 line buffer.
3 4	Not Used Not Used	The printer doesn't use these switches. It doesn't matter if they are OPEN or CLOSED.
5	CLOSED	Set to OPEN for 10 characters per each inch regardless of the size of each character. Set to CLOSED to have the printer adjust spacing for character size. Other print modes are software selectable.
6	CLOSED/ OPEN	This switch tells the printer to expect either a 7-bit or 8-bit data from the computer. If you're using an interface that uses 7-bit data, set it to CLOSED. If you're using an 8-bit interface, set it to OPEN.
7	CLOSED	If this switch is set to CLOSED, the printer will be automatically on-line (SEL LIGHT) whenever it is turned on. If you want the printer to be off-line, (NOT SEL) however, set it to OPEN.
8	OPEN	If this switch is set to OPEN, the printer will be able to print in both directions. If you set it to CLOSED, the printer will only be able to print from left to right.

11. When you finish setting the switches, make sure SW 2 looks like this:

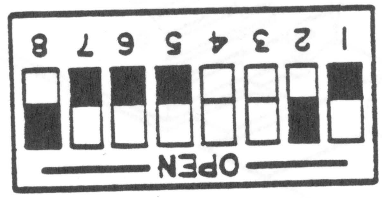


FIGURE 9

12. Push the plastic strip back over the switches.

13. Replace the carrier cover.

14. Run the self test.

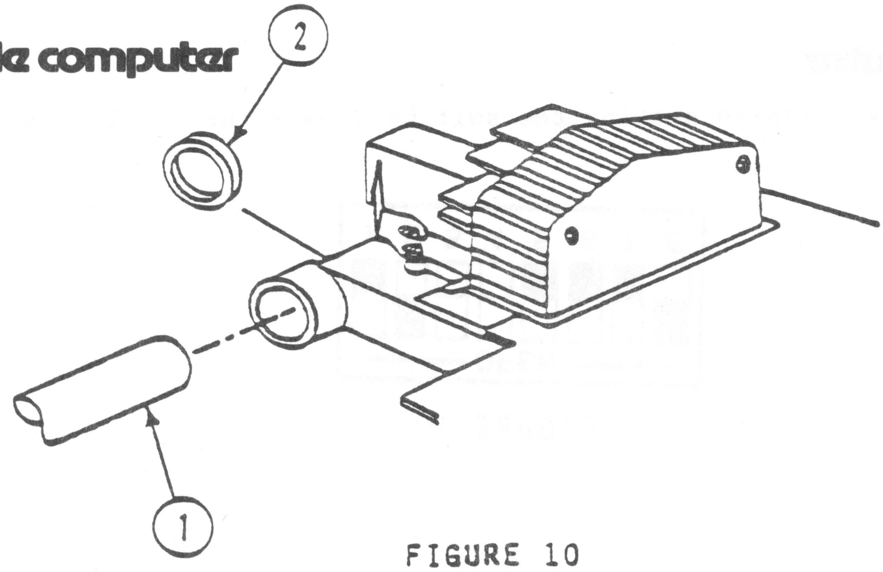


FIGURE 10

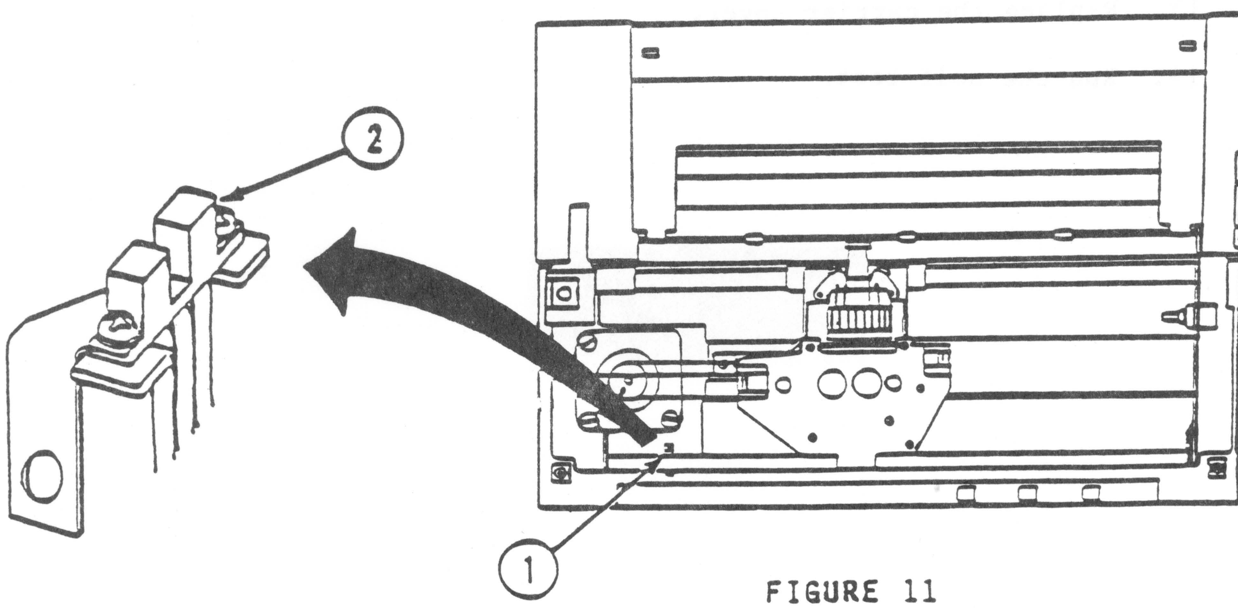


FIGURE 11

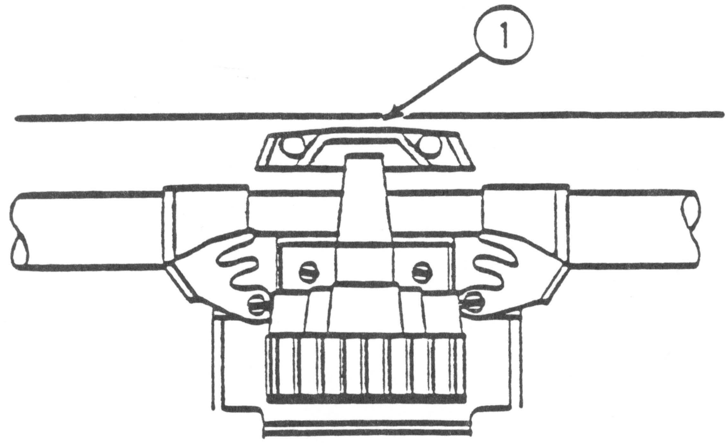


FIGURE 12

C. PERIODIC MAINTENANCE

You should clean the printer as required. You should lubricate the printer only once a year.

1. Make sure the power is off.

2. Remove the paper cover and the carrier cover.

3. Remove the paper and ribbon cassette.

4. On the carrier shaft, wipe off any dirt with dry gauze or absorbent cotton. (See Figure 10, #1.)

5. On the lubrication ring, apply a small amount of lubrication oil. (See Figure 10, #2.)

6. Find the detector plate. It is on the left front side of the printer, hidden just below the guide rail. (See Figure 11, #1.)

7. Using a brush, remove any paper dust. (See Figure 11, #2.)

8. On the head top, brush off any ribbon chips and paper dust. (See Figure 12, #1.) WARNING: Do not use alcohol to clean the dot head. **Alcohol will destroy the dot head.**

9. Replace the ribbon cassette.

[illegible]

[illegible] front side of the printer, [illegible] (See Figure 11, #1.)

[illegible] paper dust. (See Figure 11, #2.)

[illegible] ribbon chips and paper dust. (See [illegible] Do not use alcohol to clean the dot head. [illegible]

Dot Matrix Printer Technical Procedures

Section 2

Take-apart

Contents:

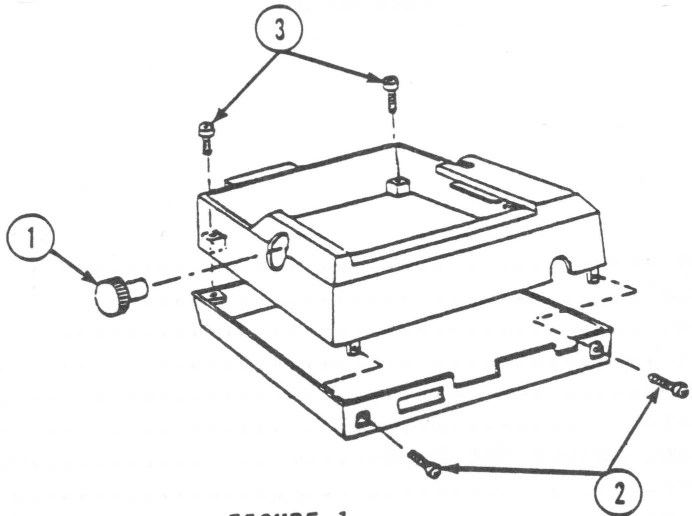


FIGURE 1

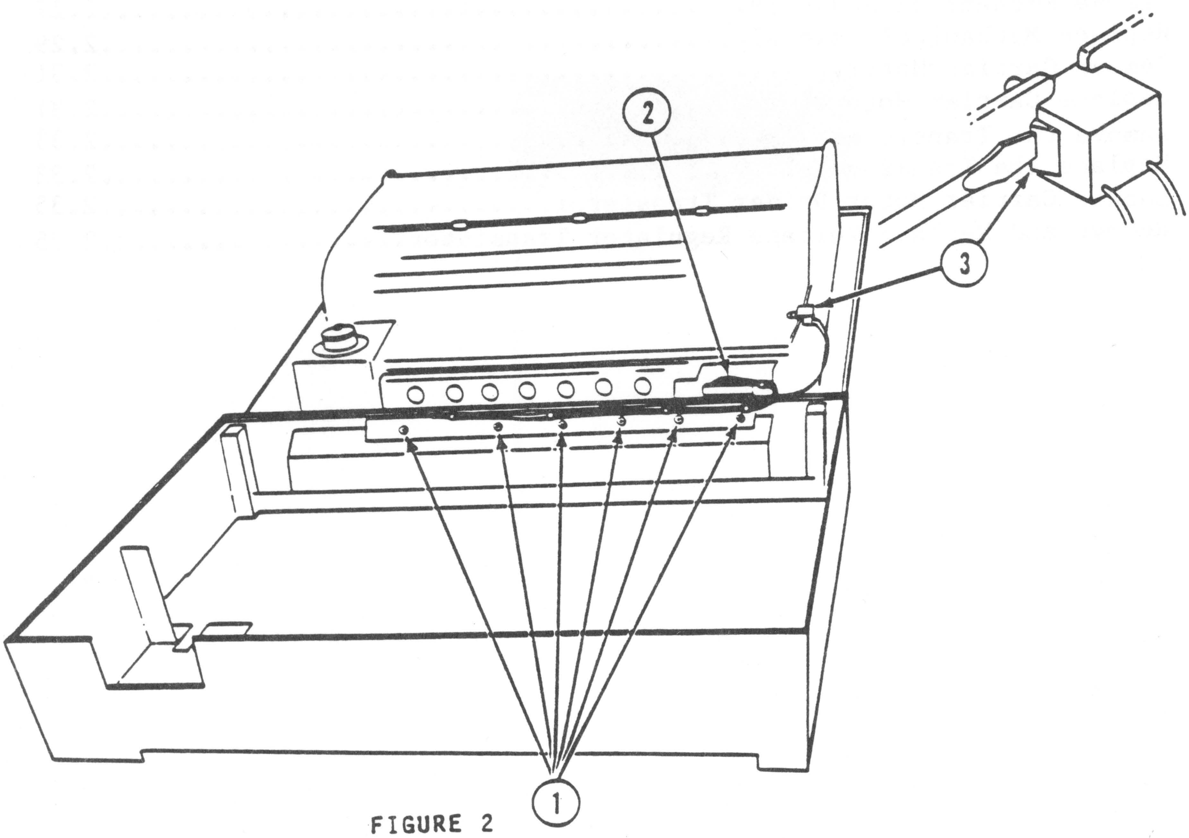


FIGURE 2

A. REMOVE AND REPLACE THE SWITCH PANEL

For these procedures you will need:

Two Phillips screwdrivers (#1, #2)
Small flat blade screwdriver

Remove:

1. Remove the power cord from printer.
2. Remove the carrier cover.
3. Pull off the platen knob. (See Figure 1, #1.) If it doesn't come off easily, place the blade of a flat blade screwdriver in the slot of the shaft of the platen knob (i.e., where the knob attaches to the platen). Twist the screwdriver, thereby widening the knob so you can pull it off.
4. To remove the top cover, remove the two screws at the rear of printer. (See Figure 1, #2.)
5. Remove the two screws at the front of printer. (See Figure 1, #3.)
6. Lift the top cover up. Place it face down on the table.
7. Remove the six screws from the back of the switch panel. (See Figure 2, #1.)
8. Pull the switch panel connector from the CPU board. The connector is in the "well" at the right front of the printer. Reach down into the "well" to find it. If you have trouble getting the connector free, carefully use a flat bladed screwdriver to pry it loose. (See Figure 2, #2.)
9. Using a flat blade screwdriver, depress the latches on both sides of the limit switch and push the switch in toward the center of the printer. (See Figure 2, #3.) Lift the wire free from the slot.
10. Pull the switch panel free.

Replace:

1. Put the switch wire back into the slot. Push the limit switch back until it clamps in place. It should be snug with side frame.

2. Attach the switch panel connector to the CPU board.

3. Replace the six screws in the back of the switch panel.

4. Pull the top cover back over the printer.

5. Replace the carrier cover and the platen knob.

6. Plug the printer back in.

7. Power on. Check that power lamp lights.

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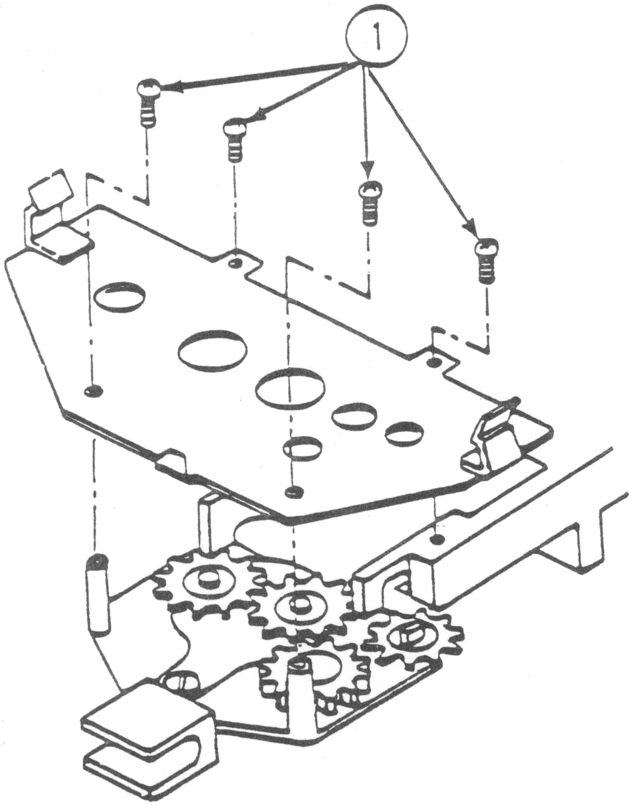


FIGURE 3

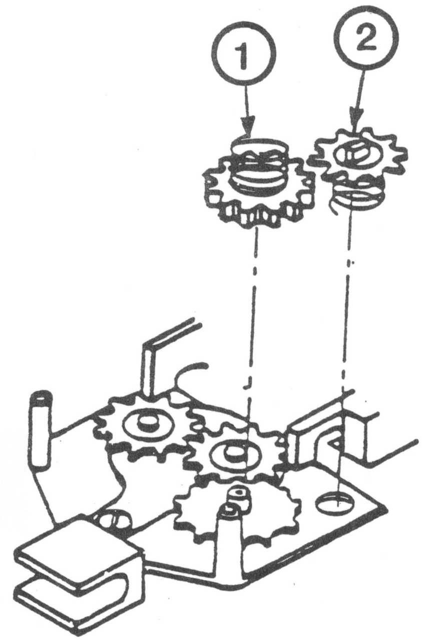


FIGURE 4

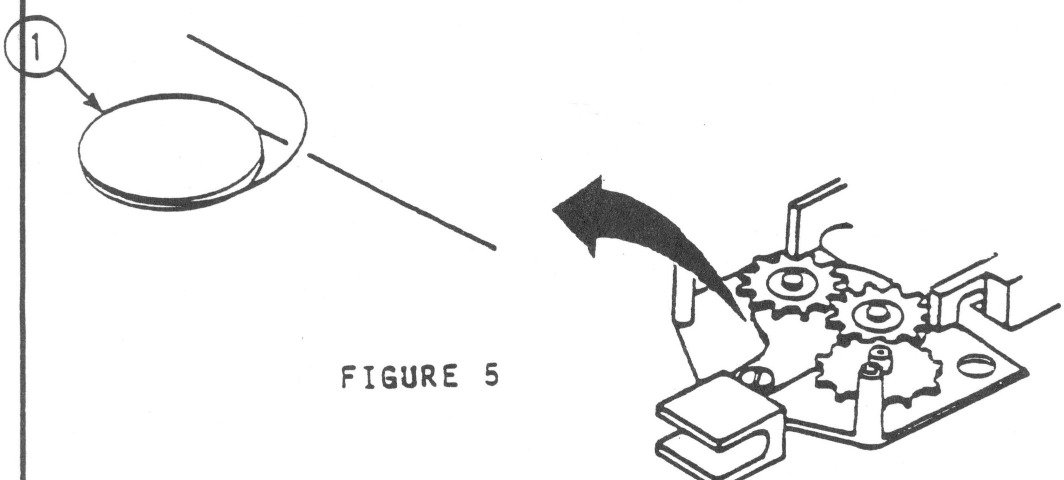


FIGURE 5

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B. REMOVE AND REPLACE THE RIBBON WIRE

For these procedures you will need:

Small Phillips screwdriver

Remove:

1. Remove the power cord.
2. Lift off the carrier cover and pull off the platen knob (Section 2A, page 2.3).
3. Lift off the top cover. Set it face down.
4. For easier access to the ribbon wire, disconnect the top cover from the printer. To do this, pull the switch panel connector from CPU board. Push the limit switch in toward center of board and lift the wire free. Remove the top cover and set it out of the way.
5. Remove the ribbon cassette (Section 1A, page 1.5).
6. Remove the four cassete mount plate fixing screws. (See Figure 3, #1.)
7. Slowly lift off the cassette mount plate.

   NOTE: There are springs beneath the cassette mount plate (See Figure 4). They may pop out when you lift up the mount plate.
8. Pull up the ratchet gear and ratchet spring. (See Figure 4, #1.) If they don't come off easily, carefully pry them off with a flat blade screwdriver.
9. Pull off the cassette drive gear and the ribbon spring. (See Figure 4, #2.)
10. Notice how the ribbon wire is wrapped around the ribbon pulley gear. (See Figure 5, #1.) Also, notice how the ribbon wire goes through the carrier assembly. This will help you when you have to replace the ribbon wire.

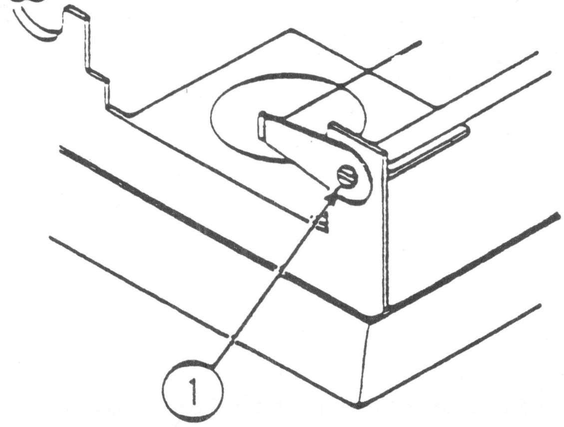


FIGURE 6

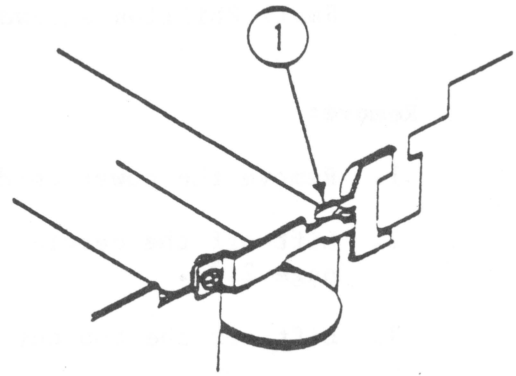


FIGURE 7

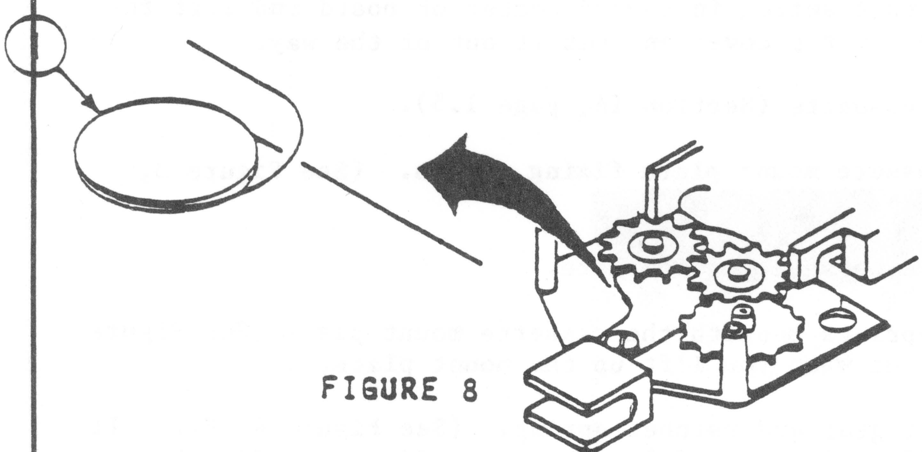


FIGURE 8

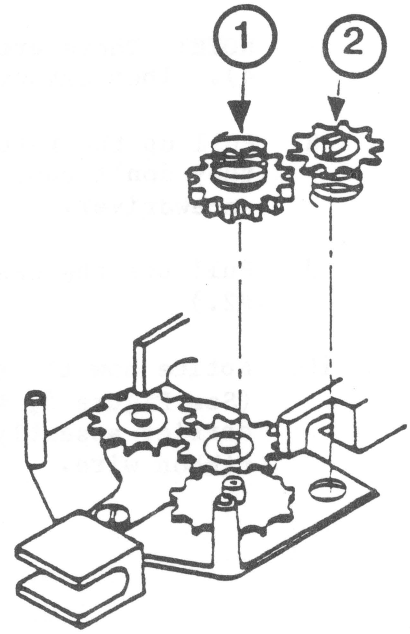


FIGURE 9

11. Loosen the screw on the ribbon wire arm on the left side of the printer (See Figure 6, #1.) Just give it a few turns to ease the tension on the wire.

12. Remove the wire from the wire holder on the right side of the printer. (See Figure 7, #1.)

13. Remove the other end of the wire from the wire holder on the left side of the printer.

14. Work the wire free from the ribbon pulley gear. Pull the wire out of the printer.

Replace:

1. Attach one end of the ribbon wire to the wire holder on the right side of the printer.

2. Work the wire around the pulley gear as shown. (See Figure 8, #1.)

3. Attach the other end of the ribbon wire to the wire holder on the left side of the printer.

4. Tighten the ribbon wire arm.

5. Replace the ratchet spring and ratchet gear. (See Figure 9, #1.)

6. Replace the ribbon spring and cassette drive gear. (See Figure 9, #2.)

7. Replace the cassette mount plate and ribbon cassette.

8. Replace the top cover, carrier cover, and platen knob.

9. Run the self-test.

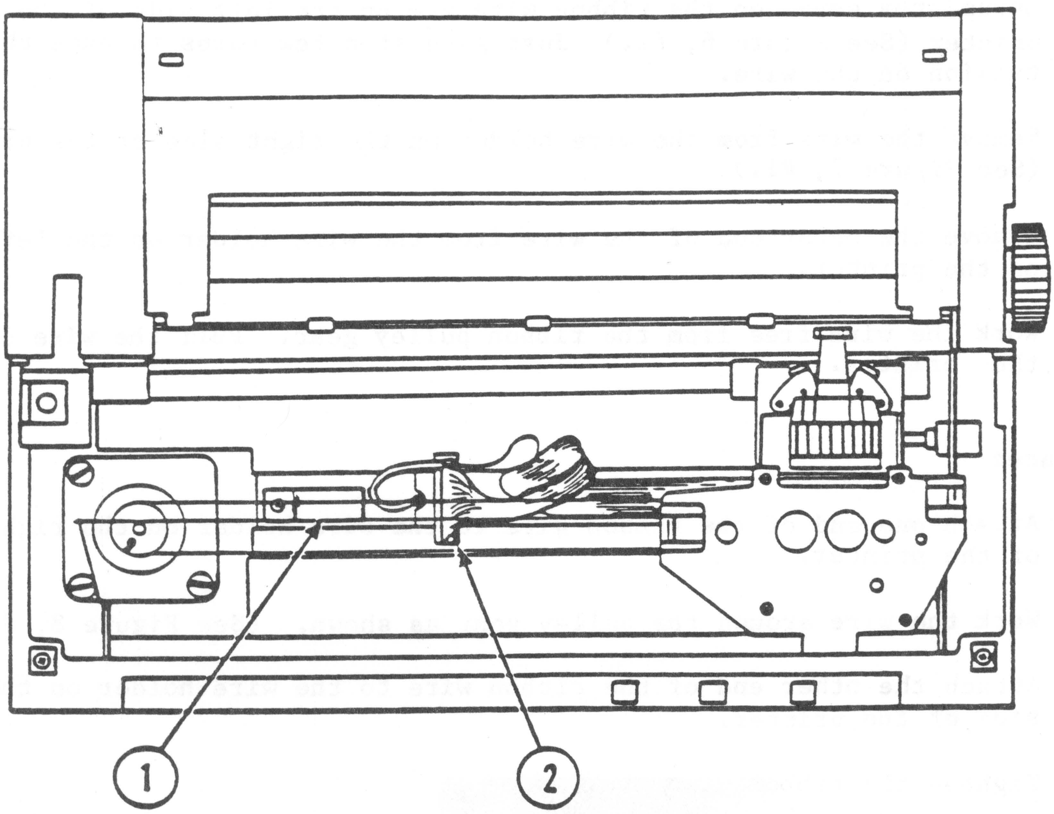


FIGURE 1

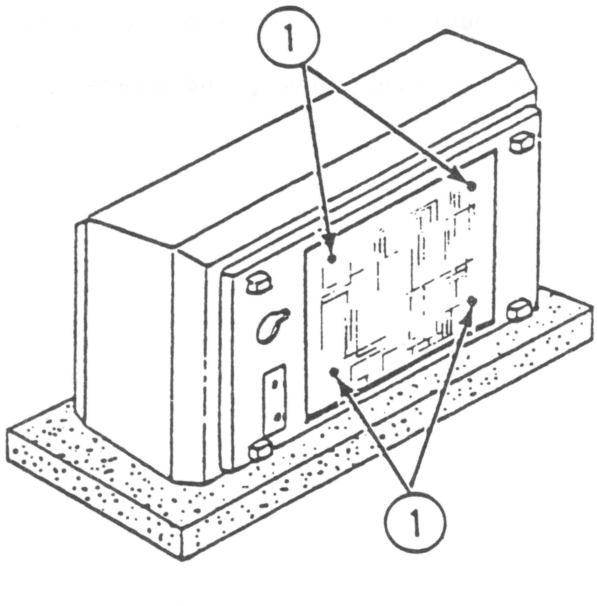


FIGURE 2

C. REMOVE/REPLACE THE CPU PC BOARD

For these procedures you will need:

5.5mm Nutdriver
8mm Nutdriver
Phillips Screwdriver

Remove:

1. Disconnect the power cord.
2. Remove the carrier cover, the paper cover and the platen knob.
3. Remove the top cover. Be sure to detach the switch panel connector from the CPU PC board. Put the cover somewhere out of the way.
4. Slide the carrier all the way to the right.
5. Loosen, but do not remove, the metal clip and gently pull up the ribbon until you can reach the dot head connector. (See Figure 1, #1.)
6. Gently work free the dot head connector. (You might use the needle nose pliers to grasp the connector.) (See Figure 1, #2.)
7. Tuck the dot head connector under the cable so it stays out of the way.
8. Using a pad or cushion for protection, set the printer on its back. (See Figure 2.)
9. Use a 5.5mm nutdriver to remove the four nuts from the bottom panel.
10. Pull off the panel.
11. Use an 8mm nutdriver to remove the four CPU PC board nuts. (See Figure 2, #1.)
12. Gently pull the board toward you. This will help you reach the plastic connectors on the board.
13. Using your fingers, work off the plastic connectors. (Do not pull on cable.) As you disconnect them, note the position of each connector.

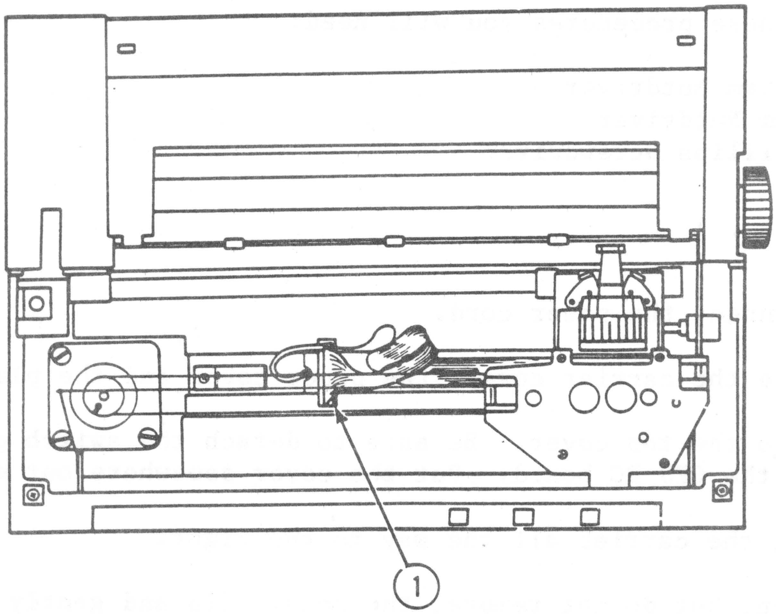


FIGURE 3

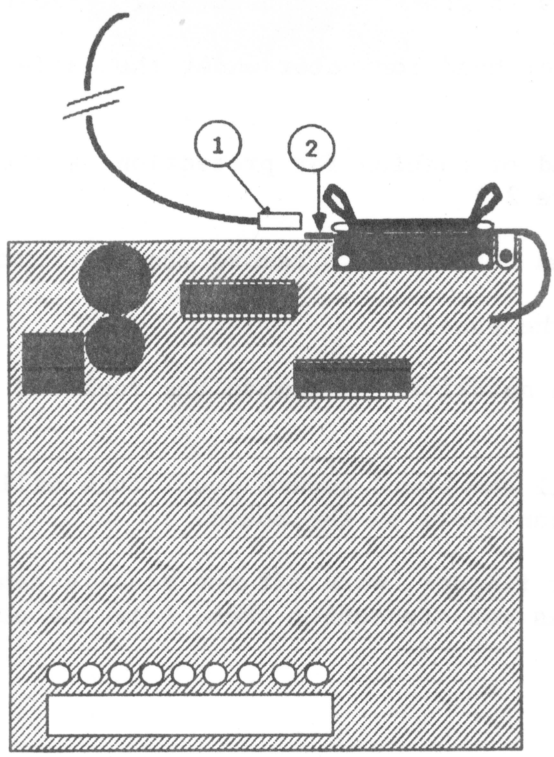


FIGURE 4

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CAUTION: THE BOARD CAN BE DAMAGED BY STATIC ELECTRICITY.

IMPORTANT CHANGE

14. When you have all the connectors off, lay the board down on table.

15. Slide the chassis grounding strap (Figure 4, #1) off the ground lug.

    IMPORTANT: Leave the ground lug (Figure 4, #2) attached to the board. If you send the board to Apple for exchange, all ground lugs must be present on the board.

16. To avoid damaging the board, be careful not to handle the surface of the board. When you carry away the board, be sure to hold it by its edges.

Replace:

1. Line up the board with printer.
2. Connect the grounding strap.
3. Connect the six plastic connectors.
4. Replace the four CPU PC board nuts.
5. Push the bottom window back into place. Connect the four window nuts.
6. Turn the printer right side up.
7. Push the dot head connector back into CPU PC board. (See Figure 3, #1.)
8. Fold the dot head cable under the metal clip. Tighten down the metal clip.
9. Slide the carrier back and forth a few times. It should slide freely from end to end. If the carrier catches on the metal clip, go back and re-fold the dot head cable.
10. Replace the top cover. Be sure to plug the switch panel connector back into the CPU PC board.
11. Replace the carrier cover, the paper cover, and the platen knob.
12. Turn the power on.
13. Perform the self-test.

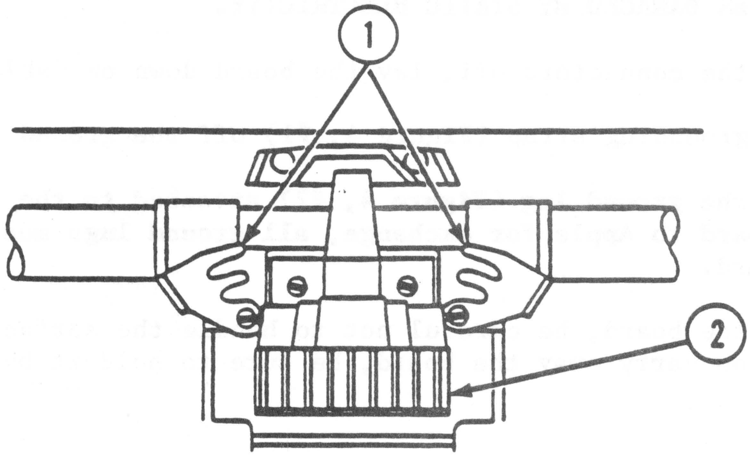


FIGURE 1

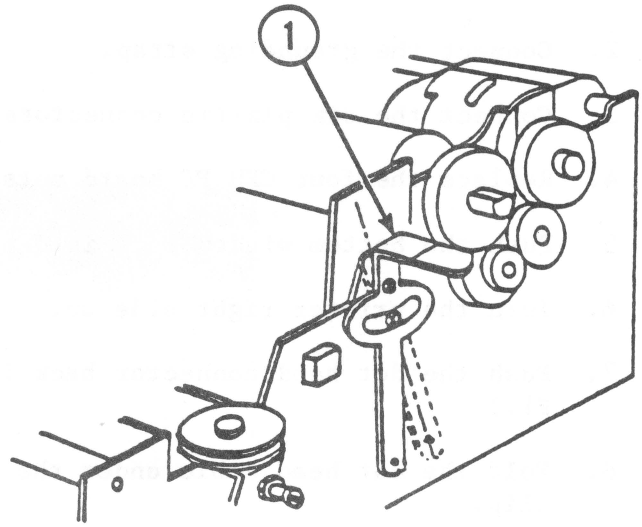


FIGURE 2

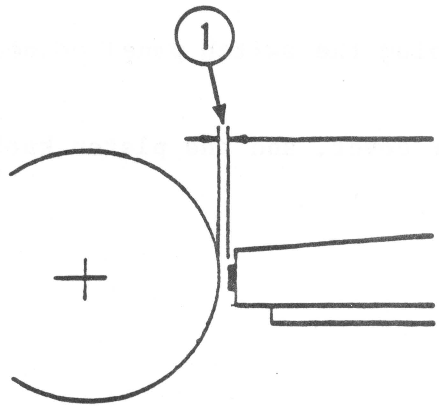


FIGURE 3

apple computer

D. REMOVE/REPLACE AND ADJUST THE DOT HEAD

For these procedures you will need:

.06mm feeler gauge

Remove:

1. Disconnect the power cord.
2. Remove the carrier cover.
3. Remove the ribbon cartridge (Section 1A, page 1.5).
4. To free the dot head, slide out both dot head latches. (See Figure 1, #1.)
5. Pull up the dot head. (See Figure 1, #2.) If you have trouble getting it out, pull the paper roller shaft forward. Ease the dot head around the roller shaft.

Replace:

1. Push in the dot head. If you have trouble getting it in, pull the paper roller shaft forward. Ease the dot head around the roller shaft.
2. To lock the dot head in place, slide in the two dot head set latches.

Adjust:

1. Push in on the head adjusting lever until it is pointing up. (See Figure 2, #1.)
2. Using a feeler gauge, check that the gap between the head needle and the platen is .06mm or .024 +/- .001 inches. (See Figure 3, #1.) This is the right gap for a single sheet of paper. Try sliding through the platen a single sheet of paper. It should go through with just a little drag.
3. If the gap is off, adjust the head adjusting lever until the gap is correct.

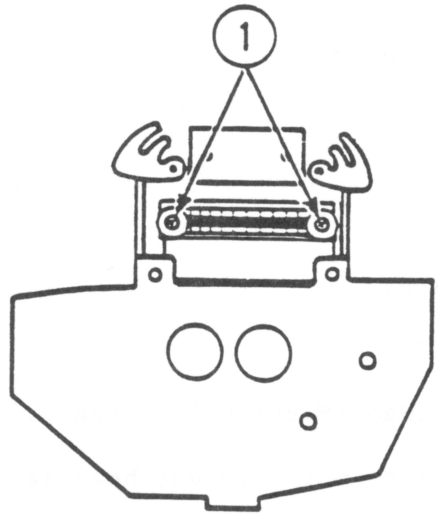


FIGURE 4

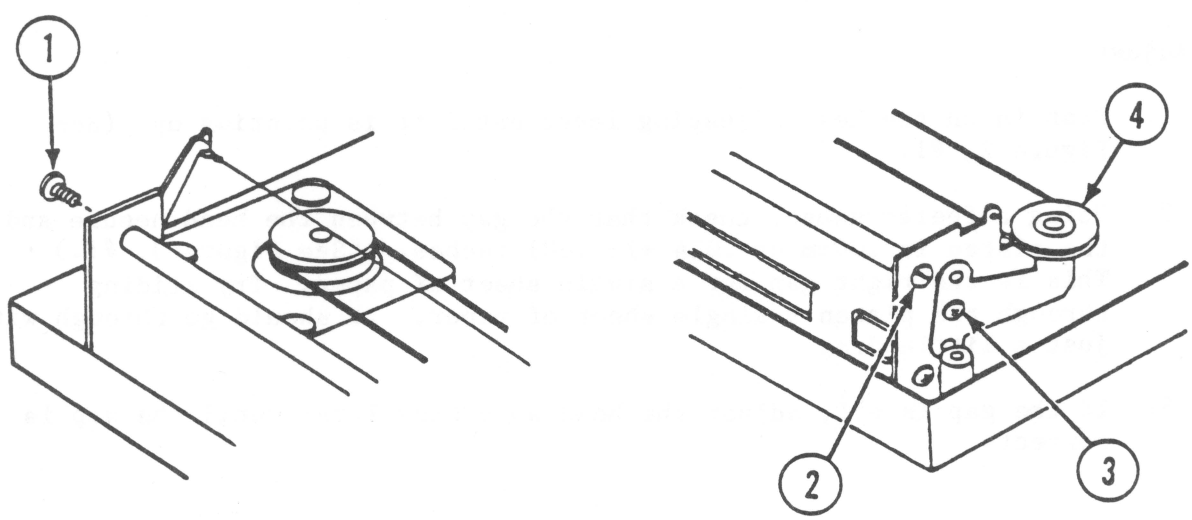


FIGURE 5

E. REMOVE/REPLACE THE CARRIER WIRE

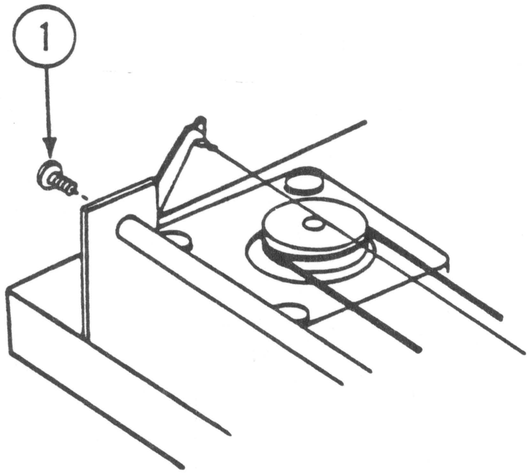
For these procedures you will need:

- Small Phillips screwdriver
- Small flat blade screwdriver
- Needlenose pliers
- Adjustable wrench
- Tension gauge
- Pulley Remover
- Ruler

Remove:

1. Disconnect the power cord.
2. Remove the paper cover, the carrier cover, and the top cover. Set the top cover somewhere out of the way.
3. Remove the dot head (Section 2D, page 2.15).
4. Remove the two screws holding the dot head connector. (See Figure 4, #1.)
5. Lift up the connector and move it out of the way.
6. Free both ends of the ribbon wire. Loop the ends over the carrier and tie them together out of the way.
7. Remove the screw on the left end of the carrier guide shaft (See Figure 5, #1) and set aside the ribbon wire arm.
8. Remove the screw on the right end of the shaft. (See Figure 5, #2.)
9. Pull out the carrier guide shaft.
10. Move the carrier to the right side.

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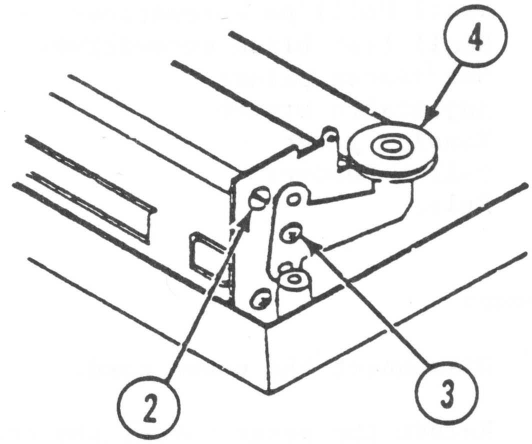


FIGURE 6

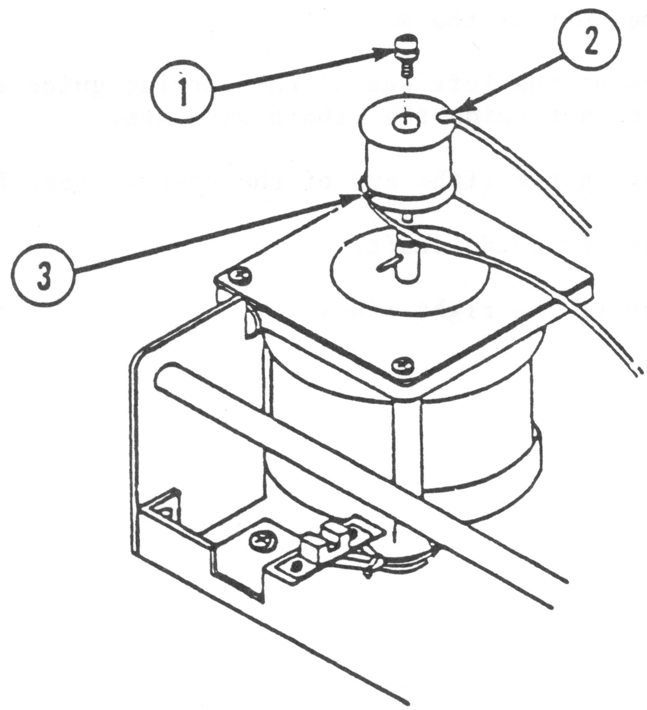


FIGURE 7

11. Use a phillips screwdriver to remove the screw from the top of the motor pulley. (See Figure 7, #1.)

    NOTE: The pulley can be stopped from turning by holding the carrier in place.

12. Loosen the screw on the tension arm. (See Figure 6, #3.)

13. Slip off the wire from the idler pulley. (See Figure 6, #4.)

14. Remove the top end of the carrier wire. (See Figure 7, #2.)

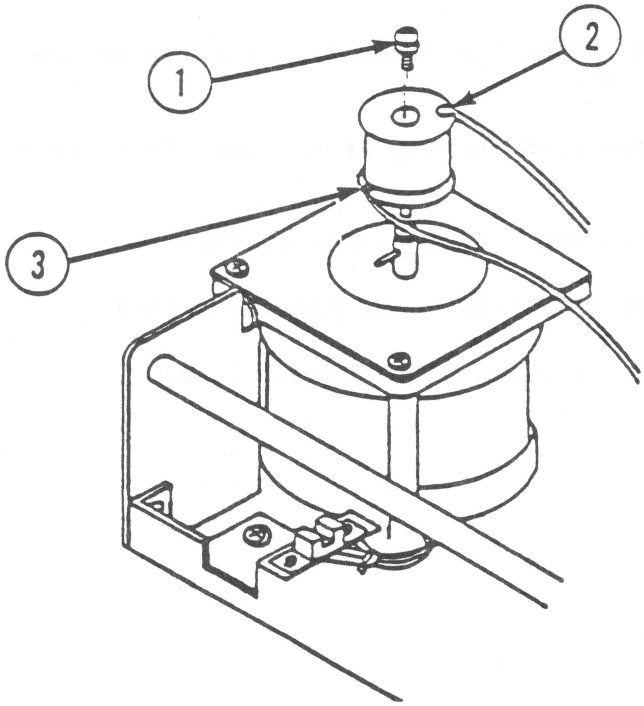


FIGURE 8

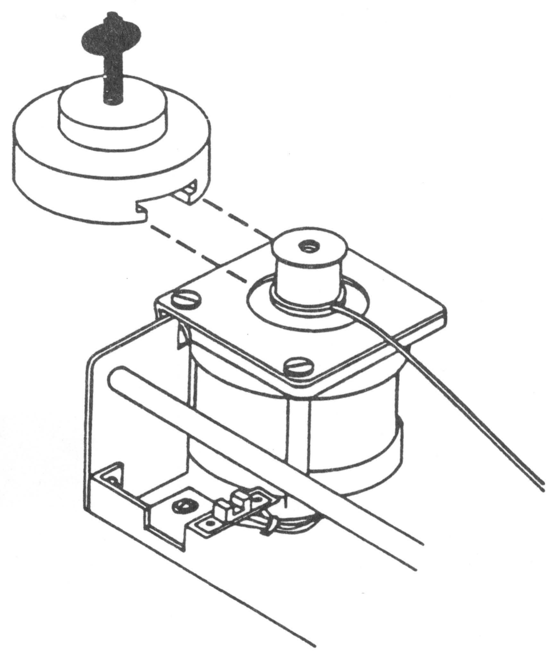


FIGURE 9

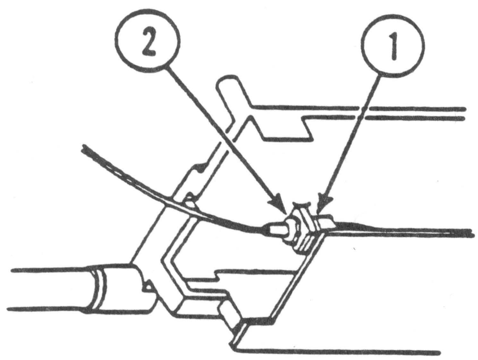


FIGURE 10

15. Use the pulley remover to take off the motor pulley. Slide the pulley remover onto the top of the pulley and turn the screw clockwise until the pulley is free. (See Figure 9.)

    NOTE: At this time, make sure that two copper shims are on the arms of the motor pulley shaft.

16. Unwind the carrier wire.

17. Remove the bottom end of the carrier wire from the motor pulley. (See Figure 8, #3.)

18. Raise up the carrier.

19. Using an adjustable wrench, hold the nut on the right side of the carrier wire in place. (See Figure 10, #1.) Using a needlenose pliers, remove the wire nut on the left side of the carrier wire. (See Figure 10, #2.)

20. Grab the carrier wire on either side of the black rubber sleeve. Pull out the carrier wire, the nuts, and the sleeve.

    NOTE: When you remove the carrier wire, first push out the metal shim which is inside, then the wire, the two nuts, and the black rubber sleeve will all come out together. The wire does not slide out of the two nuts. You must pull the wire, the nuts, and the sleeve out of the slot at the bottom of the carrier assembly.

Replace:

1. Raise up the carrier.

2. Before you insert the new carrier wire, make sure that the long end of the wire runs toward the right side of the printer.

3. Push the black rubber sleeve and metal shim back into the slot at the bottom of the carrier assembly. Tighten the wire nut.

4. Take the long end of the wire and wrap it around the idler pulley. The idler pulley is on the far right side of the printer.

5. Work the long end of the wire under the carrier assembly until it reaches the left side of the printer.

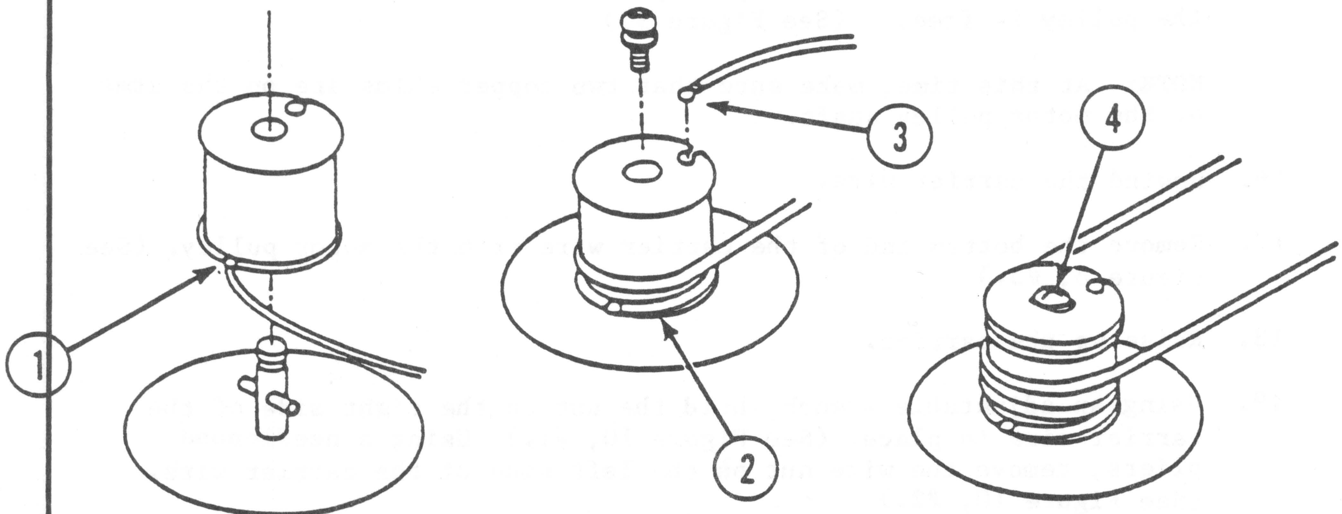


FIGURE 11

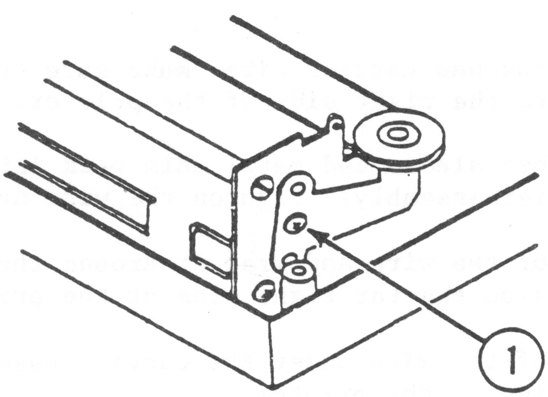


FIGURE 12

6. Insert the long end of the wire into the bottom slot on the motor pulley. (See Figure 11, #1.)

7. Make sure that the two copper shims are still on the arms of the motor pulley shaft.

8. Seat the motor pulley on the shaft. (See Figure 11, #2.)

9. Hold the wire snug against the motor pulley with your thumb. Turn the pulley in a clockwise direction and wind up the carrier wire.

10. Insert the short end of the wire into the top slot of the motor pulley. (See Figure 11, #3.)

11. Wrap the wire around the pulley in a clockwise direction.

12. Replace the motor pulley screw. (See Figure 11, #4.)

13. Replace the front guide rail.

14. Tighten the tension screw until the wire is taut. (See Figure 12, #1.)

15. Replace the two front guide rail screws and ribbon wire arm.

16. Untie the ribbon wire.

17. Attach the right end of the ribbon wire to the ribbon wire post just above the idler pulley.

18. Attach the left end of the ribbon wire to the ribbon wire post just above the motor pulley.

    NOTE: If the ribbon wire comes off of the ribbon pulley gear, you must put it back on. If you have forgotten how, see Section 2B, page 2.9.

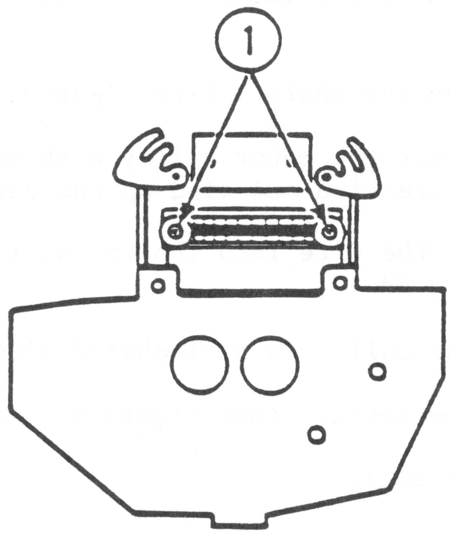


FIGURE 13

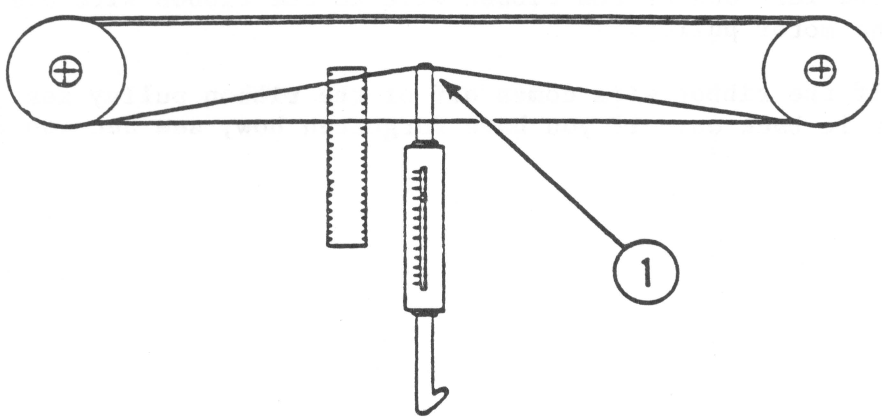


FIGURE 14

19. Replace the dot head connector. (See Figure 13, #1.)

20. Replace the dot head (Section 2D, page 2.15).

21. With the carriage assembly at the far left, push the carrier wire at its center with a tension gauge. (See Figure 14, #1.)

22. When the wire is slackened 3/8 of an inch at the center, check the gauge. It should read 1 LB. If it doesn't, adjust the screw of the tension arm.

23. Replace the top cover, the carrier cover, and the paper cover. Load paper and a ribbon cassette.

24. Run the self-test.

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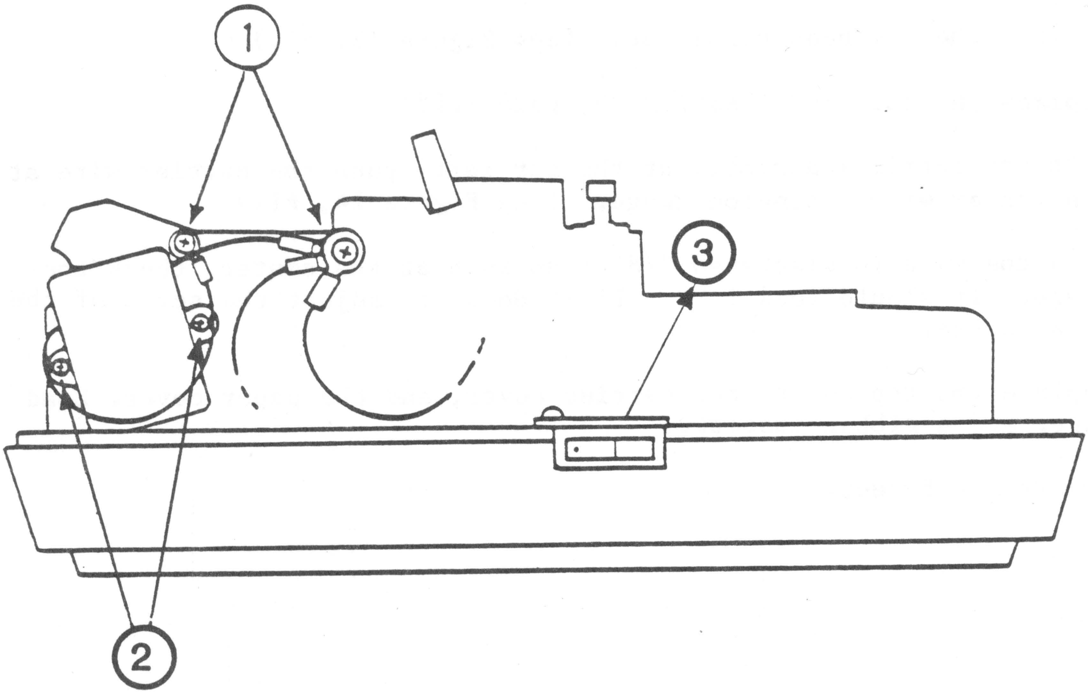


FIGURE 1

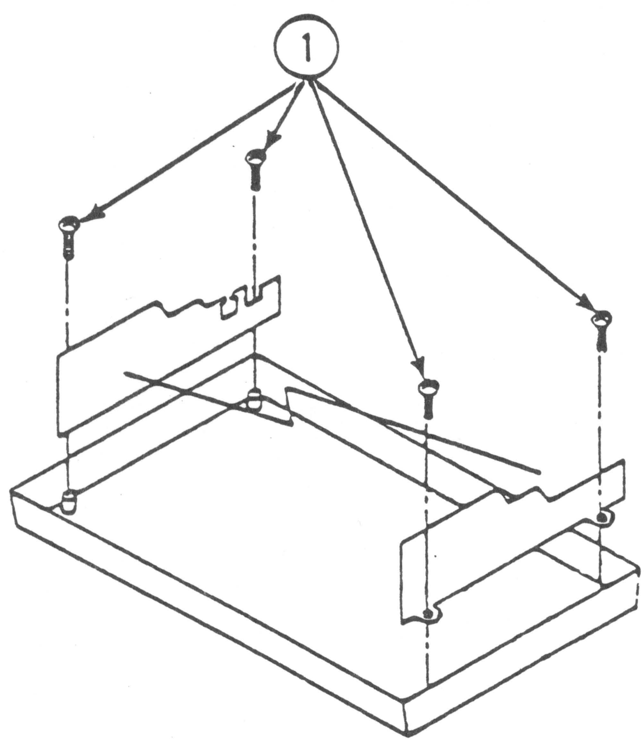


FIGURE 2

F. REMOVE AND REPLACE THE MECHANICAL ASSEMBLY

For these procedures you will need:

Small phillips screwdriver
5.5mm Nutdriver
8mm Nutdriver

Remove

1. Disconnect the power cord.
2. Remove the paper cover, the carrier cover, and the top cover. Set the top cover down out of the way.
3. Remove the CPU board (Section 2C, page 2.11).
4. Remove the screw and washers holding ground straps to the side frame. (See Figure 1, #1.)
5. Remove the two screws from the noise filter. (See Figure 1, #2.)
6. Gently pull the noise filter away from the frame.
7. Remove screw from plate over power switch. (See Figure 1, #3.)
8. Lift power switch out of its slot.
9. To free the mechanical assembly, remove the four screws holding it to the printer. (See Figure 2, #1.)
10. Lift the mechanical assembly out of the printer.

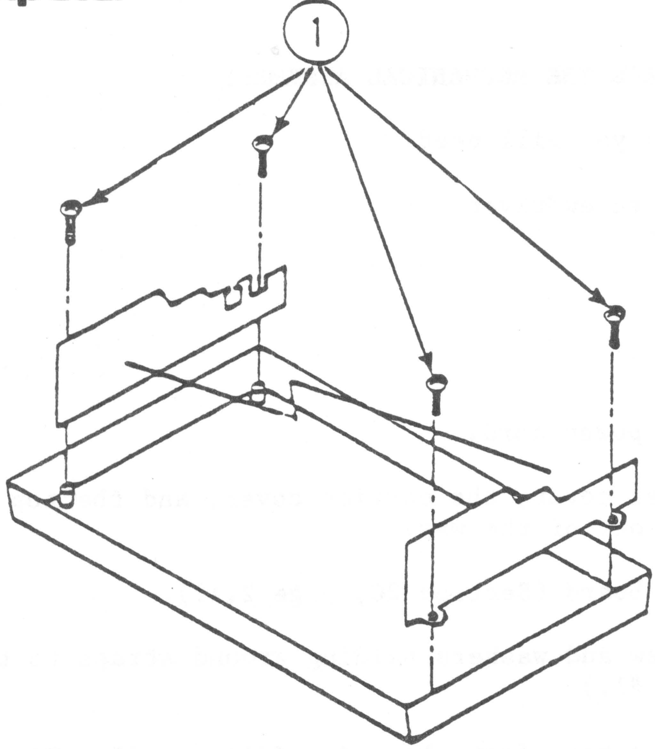


FIGURE 3

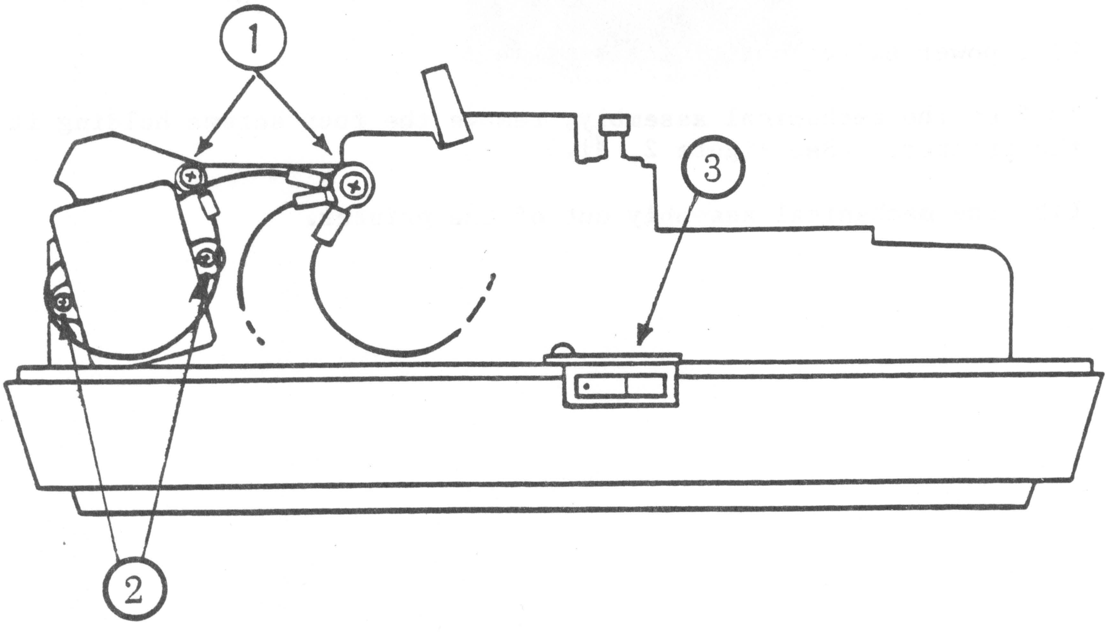


FIGURE 4

Replace

1. Put mechanical assembly back into the case.
2. Replace the four screws. (See Figure 3, #1.)
3. Position the noise filter on the frame. It goes at an angle (See Figure 4, #1.)
4. Replace the noise filter screws.
5. Put together the screw, washer, three ground cables, and star washer. Screw them into the side frame. Do the same with the fourth ground cable. (See Figure 4, #2.)
6. Put the power switch back into its slot.
7. Replace the plate over the power switch. (See Figure 4, #3.)
8. Replace the CPU board (Section 2C. page 2.13).
9. Replace the top cover, carrier cover, and paper cover.
10. Load paper and ribbon cassette.
11. Power on and perform the self-test.

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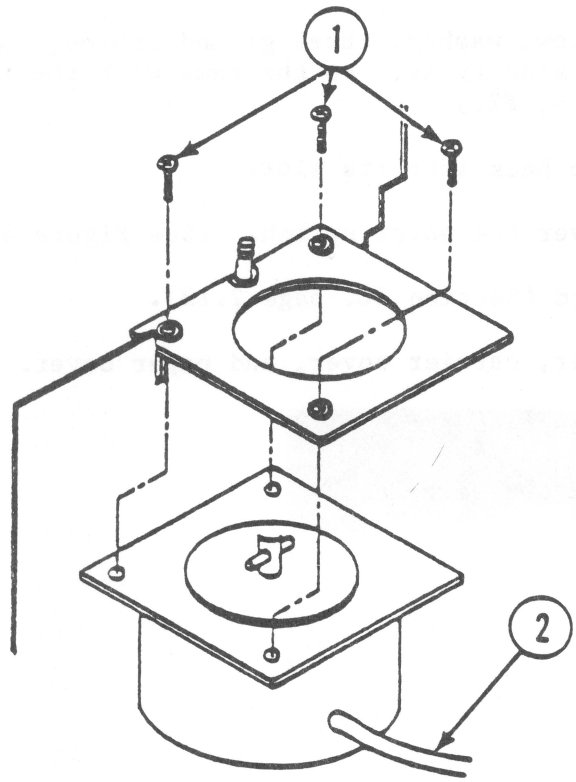


FIGURE 3

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REMOVE AND REPLACE THE CARRIER MOTOR

Medium flat blade screwdriver
Phillips screwdriver
Pulley remover

Remove:

1. Make sure the power is off.

2. Remove the mechanical assembly from the printer.

3. Loosen the ribbon wire tension arm.

4. Free the ribbon wire from the two ribbon wire posts.

5. Tie the wire in a loose knot over the carrier.

6. Remove the motor pulley as you did in Section 2E, page 2.17.

7. Remove the three motor mounting screws. (See Figure 3, #1.)

   NOTE: When you remove the last screw, the motor will drop out of the mechanical assembly. As you remove the last screw, hold on to the motor. Carefully note the position of the motor cable. (See Figure 3, #2.) Then let motor fall free.

Replace:

1. From the front side of the mechanical assembly, put the motor in its slot. Make sure the cable is on the right side of the motor. It should be pointing in the general direction of the idler pulley.

2. Replace the three motor mounting screws. Do not over tighten them.

3. Replace the motor pulley. If you have forgotten how, see Section 2E, page 2.17.
4. Put the motor pulley back on the motor.

5. Replace the motor pulley screw.

6. Untie the ribbon wire.

7. Fix the ribbon wire to the ribbon wire posts.

8. Tighten the ribbon wire arm.

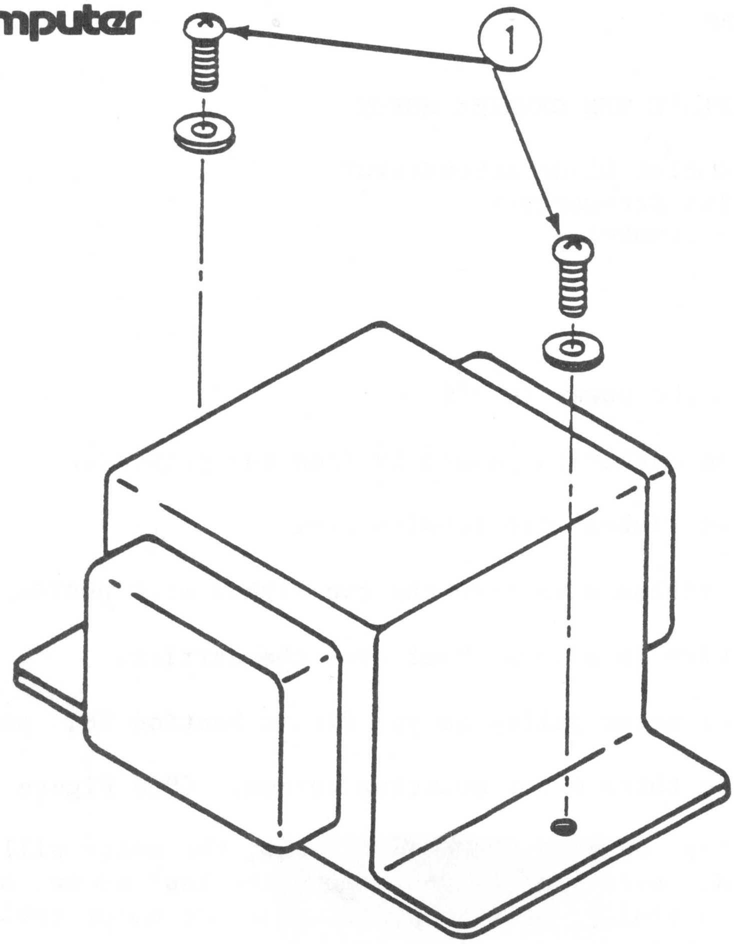


FIGURE 1

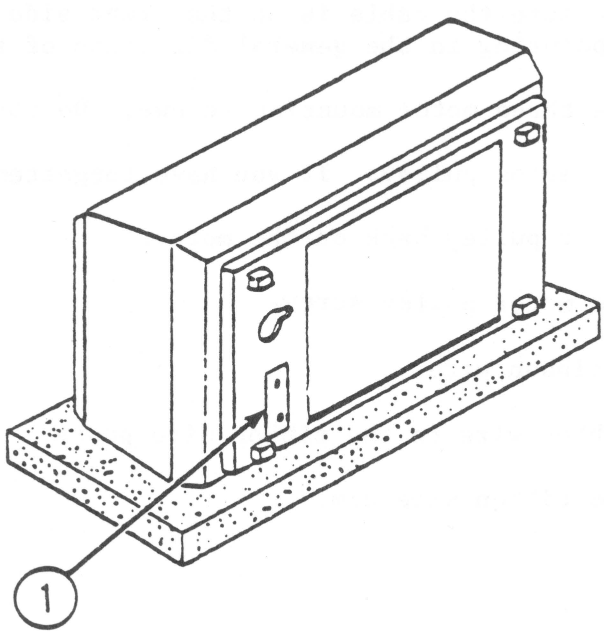


FIGURE 2

apple computer

H. REMOVE AND REPLACE THE TRANSFORMER

For these procedures you will need:

Needlenose pliers
Small Phillips screwdriver

Remove:

1. Remove the mechanical assembly (Section 2F, 2.27).
2. Remove the two screws from the transformer. (See Figure 1, #1.)

Replace:

1. Make sure the threaded plate under the bottom of the printer is in position. (See Figure 2, #1.)
2. Put the transformer in place.
3. Screw down the transformer.

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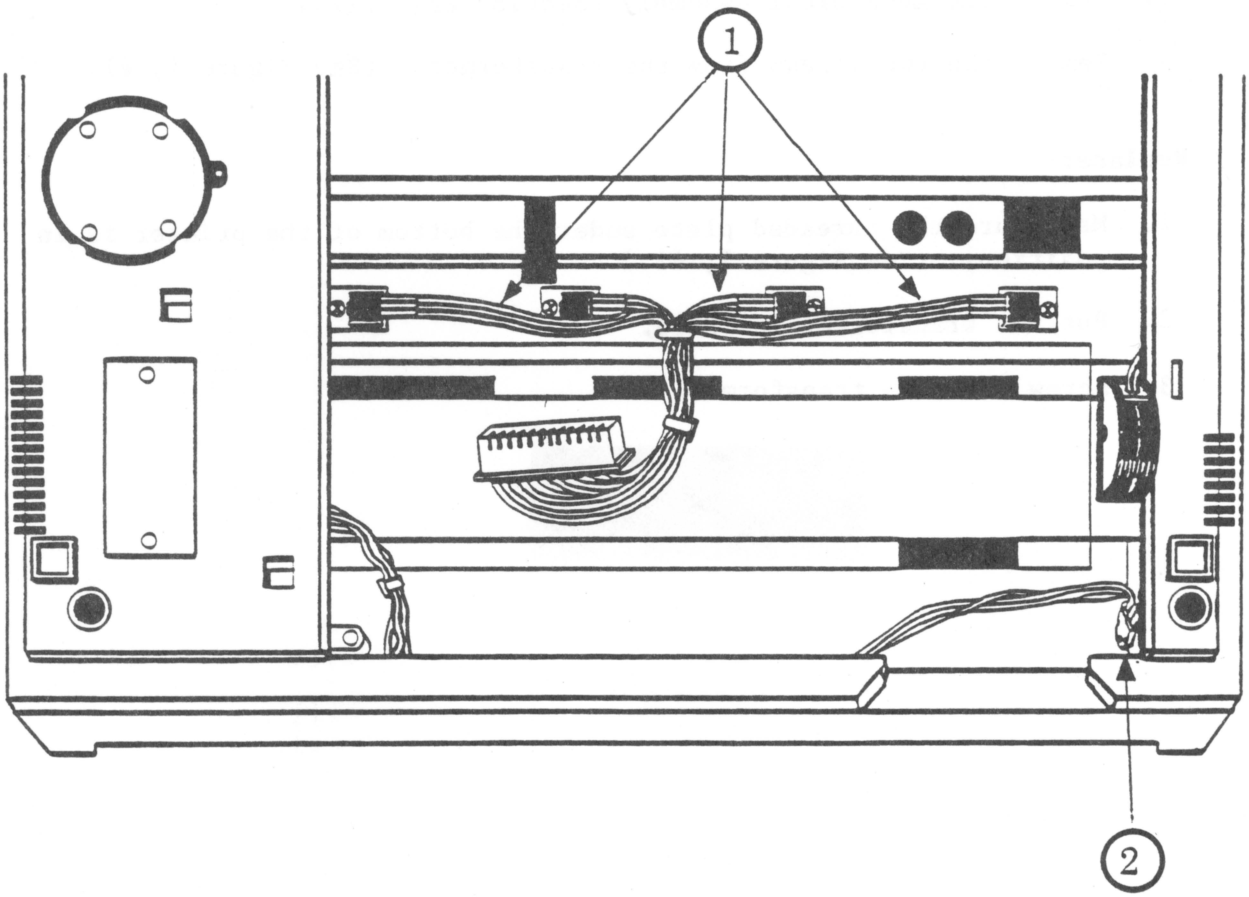


FIGURE 4

I. LOCATE THE CARRIER MOTOR DRIVER TRANSISTOR

1. Remove the mechanical assembly (Section 2F, page 2.27).

2. Turn the mechanical assembly upside down and place it on a protective pad.

3. Note the location of the transistor assembly in Figure 4, #1.

J. REMOVE AND REPLACE THE VOLTAGE REGULATOR TRANSISTOR

For this procedure you will need:

Heat sink compound
Phillips head screwdriver

1. Remove the mechanical assembly (Section 2F, page 2.27).

2. Turn the mechanical assembly upside down and place it on a protective pad.

3. Remove the screw from the voltage regulator transistor (Figure 4, #2) and carefully remove the transistor.

4. To replace the voltage regulator transistor spread a thin layer of heat sink compound on the mechanical assembly. Place the sheet of mylar on top of it. Apply a layer of heat sink compound on top of the mylar, and screw on the transistor.

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Dot Matrix Printer Technical Procedures

Section 3

Troubleshooting

Contents:

NOTE: The Dot Matrix Printer should be tested with the Apple II Peripherals Diskette. (See **Multi-Product Diagnostics Technical Procedures, Section 1.**)

SYMPTOM TABLE

SYMPTOM	CORRECTIVE ACTIONS
NO POWER	1. Check that the power cord is plugged in. 2. Check if the power fuse at the back of the printer is burned out. If it is, replace it and power on again. If the fuse blows a second time, swap components in this order: o Regulator transistor o CPU PC board o Carrier Motor o Transformer 3. If the fuse is O.K., you may have a bad power switch. Try replacing it. If that doesn't take care of the problem, swap the Carrier Motor and then the Transformer.
POWER COMES ON BUT PRINTER WON'T PRINT	1. Check if the top cover is seated properly. If it isn't, close it. Then press SEL and try self-test. 2. Check if PE lamp is lit on front panel. If it is, reload the paper and try self-test. 3. Check the connectors between the carrier and carrier motor and the CPU PC board. If any of the connectors are loose, connect them. 4. Try swapping components in this order: o CPU PC board o Carrier motor o Transistor assembly
PRINTER PASSES SELF-TEST BUT WON'T PRINT UNDER COMPUTER CONTROL	1. Check that the computer is properly powered on and initialized. 2. Make sure there isn't a software problem. 3. Make sure that the interface cable between the printer and the computer is connected at both ends. 4. Check if SEL light is on. If it's off, press SEL and try printing under computer control. If it prints while light is off, replace the switch panel. 5. Replace CPU PC board.

	SYMPTOM TABLE
SYMPTOM	**CORRECTIVE ACTIONS**
PRINT QUALITY PROBLEM: DOTS MISSING	1. Make sure dot head is in place. 2. Make sure dot head is not clogged with dust or dirt. 3. Make sure dot head connector is plugged properly into CPU PC board. 4. Make sure gap adjustment lever is set properly. 5. Try replacing components in this order: ● Dot head ● CPU PC board
PRINT QUALITY PROBLEM: PRINTING TOO LIGHT	1. Check if ribbon is old, torn, frayed, or twisted. 2. Check if ribbon wire tension is too loose and adjust as necessary. 3. Check if gap adjustment lever is set properly. 4. Adjust intensity pot. To do this, lift the clear plastic sheet that covers the configuration switches. Locate VR2 IMPRES. Insert a screwdriver into the slot on VR2. Turn the screwdriver. 5. Try replacing components in this order: ● Ribbon cassette ● Dot head ● CPU PC board
PRINT QUALITY PROBLEM: CHARACTERS NOT SPACED PROPERLY	1. Check if carrier wire is strung properly. 2. Try swapping components in this order ● Carrier wire ● Carrier motor ● CPU PC board

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	SYMPTOM TABLE
SYMPTOM	**CORRECTIVE ACTIONS**
PRINT QUALITY PROBLEM: CHARACTERS DO NOT ALIGN VERTICALLY BETWEEN ROWS	1. Adjust bidirectional pot. To do this, push back the clear plastic sheet the covers the configuration switches. Locate VR1 ALIGN. Insert a a screwdriver into the slot on VR1. Turn the screwdriver.
CARRIER ASSEMBLY MOVING ERRATICALLY: CARRIER SHAKING, MOVING SLOWLY, OR GIVING OFF BURNING ODOR	1. Try swapping components in this order • Carrier motor • Transistor assembly • CPU PC board

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Dot Matrix Printer Technical Procedures

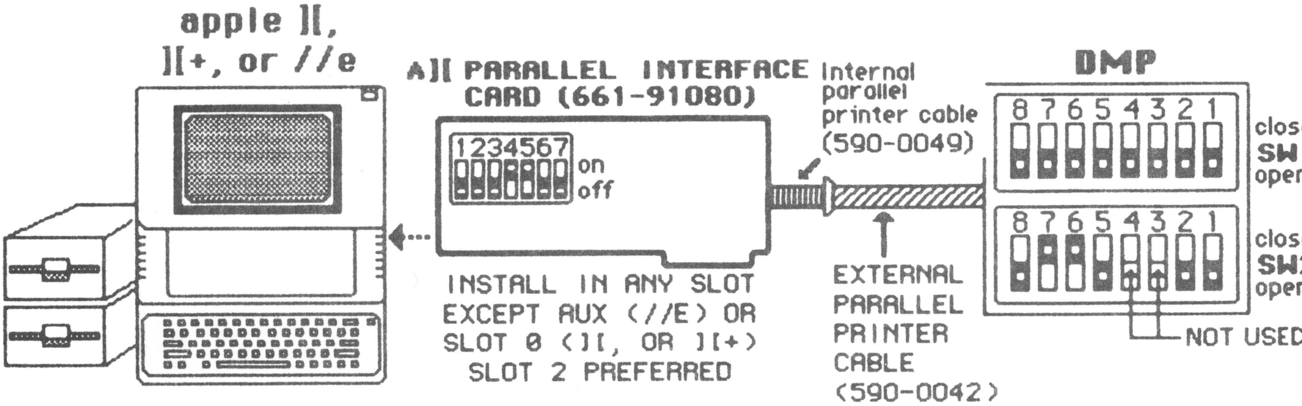
Section 4

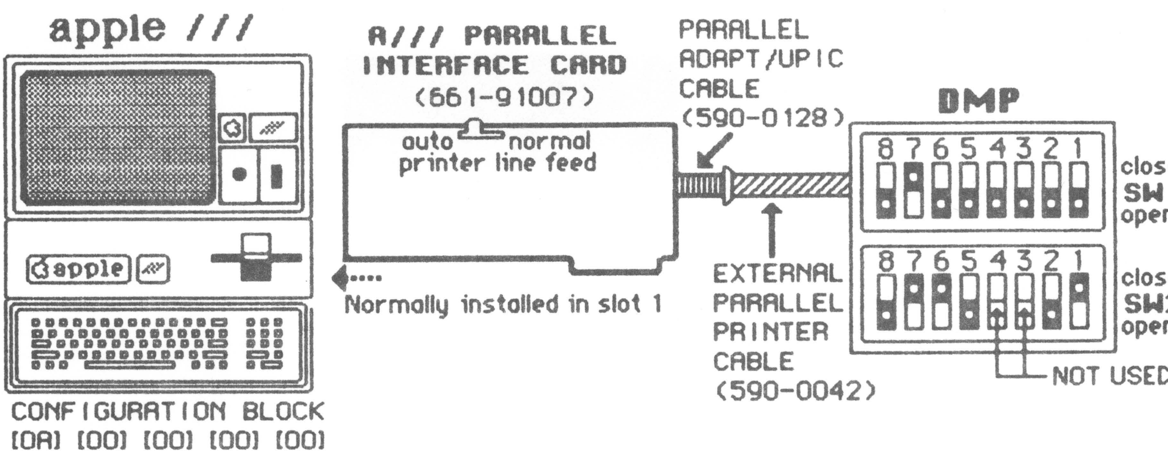
Appendix

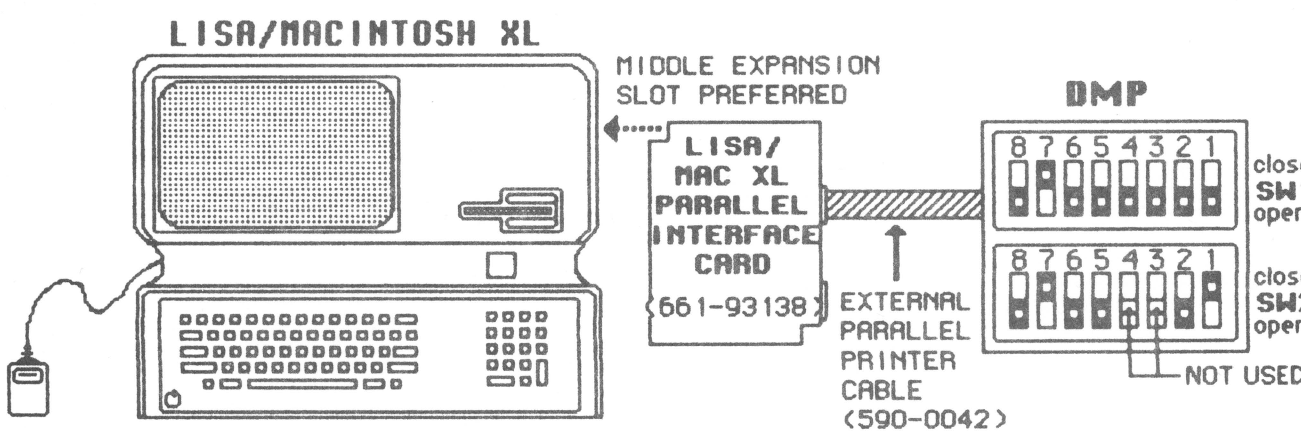
Contents:

DMP

DOT MATRIX PRINTER CONFIGURATION







- SWITCH HANDLE OR ROCKER IS IN UP (CLOSED OR ON) POSITION

- SWITCH HANDLE OR ROCKER IS IN DOWN (OPEN OR OFF) POSITION

TIMD 3/85

DOT MATRIX PRINTER (Figure 1)

Item	Part No.	Description
1	970-0008	Knob, Platen
2	699-0092	Print Head Assembly
3	970-0007	PCB Front Panel w/harness
4	970-0080	Wire Carriage Drive
5	699-0093	Carriage Drive Motor, Complete
6	970-0009	Lever, Paper Release
7	740-0101	Fuse, 2 Amp, 3AG
8	970-0078	DMP Paper Cover

DOT MATRIX PRINTER (Figure 2)

Item	Part No.	Description
1	970-0011	Switch, AC Line (115V)
2	699-0095	Transformer/Switch Assembly

DOT MATRIX PRINTER (Figure 3)

Item	Part No.	Description
1	740-0022	Fuse, 5 Amp
2	740-0021	Fuse, 3 Amp
3	661-75091	DMP CPU Card

REV.	ZONE	ECO #	REVISION	APPD	DATE

NOTE: UNLESS OTHERWISE SPECIFIED

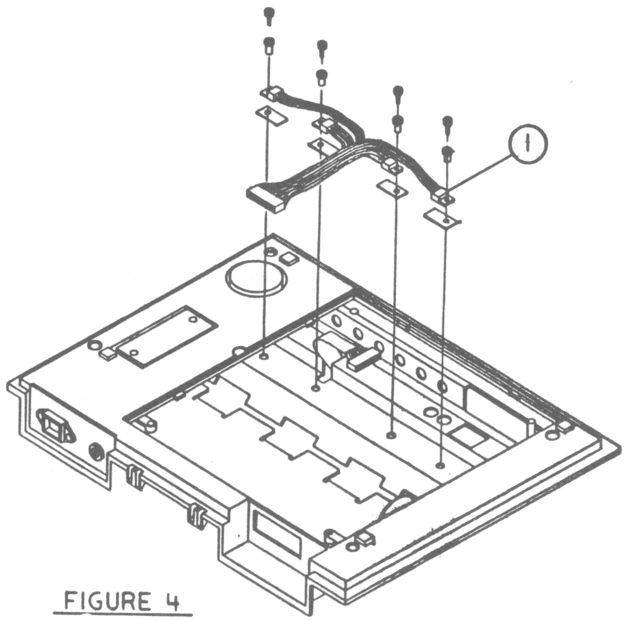


FIGURE 4

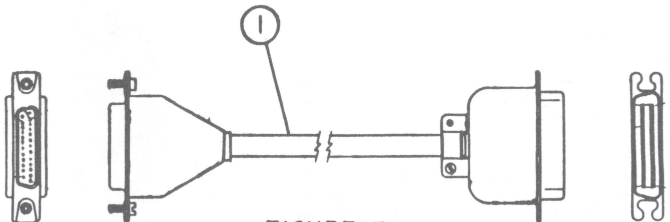


FIGURE 5

METRIC

DIMENSIONS ARE IN MILLIMETERS
TOLERANCES
.X ± —— .XXO± ——
.XX ± —— ANGLES ± ——
DO NOT SCALE DRAWING

MATERIAL:	FINISH:
DRFT Tom Inzun 6/85	DRFT CK
ENG APPVL	MFG APPVL
RELEASE	ORIG DIV SERVICE
DESIGNER	SCALE N/A

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NOTICE OF PROPRIETARY PROPERTY

TITLE ILLUSTRATED PARTS LIST D.M.P.

SIZE	DRAWING NUMBER	SHT
B	070 0199 A	2/2

DRAWING NUMBER 070-0199-A SHT 2/2

DOT MATRIX PRINTER (Figure 4)

Item	Part No.	Description
1	699-0120	Transistors Assy, Carrier Drive

DOT MATRIX PRINTER (Figure 5)

Item	Part No.	Description
1	590-0042	Cable, External Parallel Printer

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CARRIAGE ASSEMBLY 661-75089 — Carriage Assembly (complete)

Figure 7 Item #	Part #	Description
1	970-0032	Latch, Ribbon Box
2	970-0024	Spring, Extension (ribbon latch)
3	970-0034	Stepper Motor, Ribbon Feed
4	970-0004	Felt Wiper, Carriage
5	970-0033	Pulley Assembly, Ribbon Rewind
6	970-0076	Drive Gear, Ribbon Clutch
7	970-0079	Drive Belt, Ribbon Rewind
8	970-0021	Photon Module (EOR)
9	970-0612	Cleat, Belt
10	970-0614	Screw 4-40 X 5/16 SEMS
11	970-0615	Drive Key, Ribbon Drive
12	970-0616	Spring, Compression (Ribbon Dr Key)
13	970-0617	Pulley, Timing (Ribbon)
14	970-0001	Drive Belt, Timing
15	970-0722	Yoke, Bearing
*A		Eccentric lobe
*B		Eccentric screw
*C		Eccentric washer
*D		Plate, Ribbon Plate Lock

* These parts are now obsolete. If one of them requires replacement, replace all four with the following new parts:

A	970-0626	Bracket, Ribbon Plate Adjust (1ea.); replaces eccentric lobe
B	970-0625	Screw 6-32 X .562 (2ea.); replaces eccentric screw
C	970-0628	Washer #6 (2ea.); replaces eccentric washer
D	970-0627	Plate, Ribbon Plate Lock (1ea.); replaces eccentric lobe

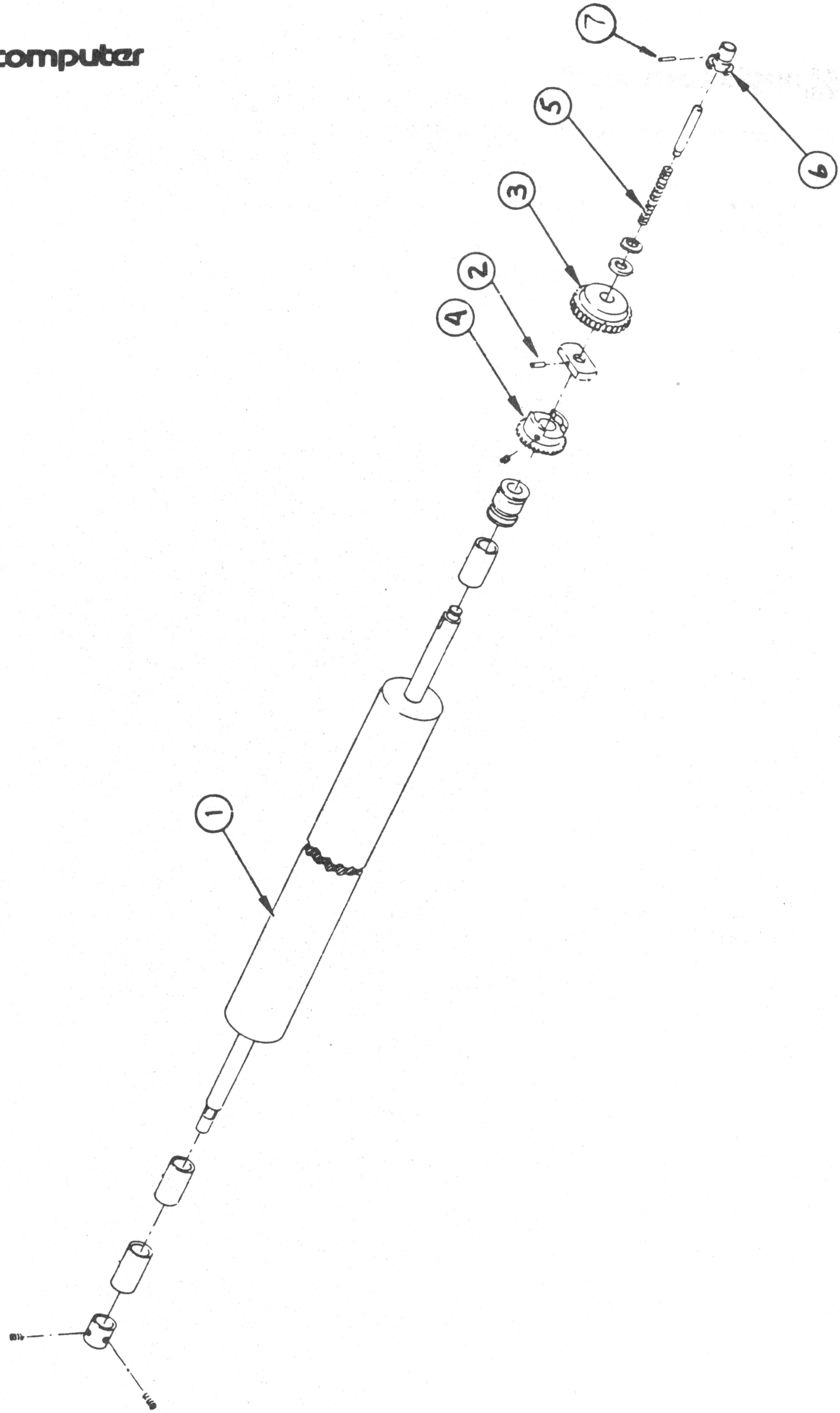


FIGURE 8

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PLATEN ASSEMBLY **699-0101** **Platen Assembly complete**

Figure 8 Item #	Part #	Description
1	699-0098	Core, Platen
2	970-0035	Needle Roll
3	970-0016	Gear, Platen
4	970-0602	Gear, Tractor Drive
5	970-0603	Spring, Compression
6	970-0604	Adapter, Platen Knob
7	970-0979	Roll Pin

PARTS NOT ILLUSTRATED

Part #	Description
699-0103	Shield Assembly, Ribbon
970-0010	Switch, AC Line
661-75088	PCB, Power Supply, 115 Volt
661-75101	PCB, Power Supply, 220 Volt
740-0030	Fuse, Pico 2 Amp
740-0031	Fuse, Pico 4 Amp
740-0032	Fuse, Pico 5 Amp

Daisywheel Printer

apple computer

APPLE DAISY WHEEL PRINTER REVISIONS

1/84

This revision of the DWP procedures is designed as a self-training course as well as a reference. Several procedures have been simplified, and the rest clarified, so that a new technician can work through the DWP procedures at your shop without needing a Level 1 course. (Less experienced technicians can go through these procedures at the Level 1 Training Center as an option in the Basic Course.)

HERE'S WHAT TO DO

1. DISCARD SECTIONS 1 - 4 OF THE 12/82 REVISION OF THE DWP TECHNICAL PROCEDURES. REPLACE THEM WITH THE NEW SECTIONS 1-4 ENCLOSED.

2. MAKE THE FOLLOWING CORRECTIONS IN YOUR COPY OF SECTION 5 (Preventive Maintenance):

page 5.3: Under the heading **"Field Service - perform as required,"** change step 3 to read:

> 3. Check print quality by running Terminal Self-Test (see **Basics**).

page 5.5: Under the heading **CLEANING: Printwheel:**, change step 4 to read:

> 4. Thoroughly rinse in clean water and dry.

page 5.11: Change step 7 to read:

> 7. Adjust the print hammer rear stop (hammer armature rear stop) (see **Print Quality Adjustments**).

3. ADD SECTION 6 AND APPENDIX A TO THE DWP SECTION OF YOUR TECHNICAL PROCEDURES MANUAL.

A Table of Contents and Section 7 (Sheet Feeder Technical Procedures) will follow in a future mailing.

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APPLE DAISY WHEEL PRINTER

TECHNICAL PROCEDURES

TABLE OF CONTENTS

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APPLE DAISY WHEEL PRINTER
TECHNICAL PROCEDURES

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Section 1: Basics

Section 2: Troubleshooting

Section 3: Take-Apart

Procedures

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Section 4: Print Quality Adjustments

Section 5: Preventive Maintenance

Section 6: Forms Tractor Technical Procedures

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Section 7: Sheet Feeder Technical Procedures

Section 8. DWP Illustrated Parts List

Section 9. Sheet Feeder Illustrated Parts List

Section 10. Appendix

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Apple Daisy Wheel Printer
Technical Procedures

Section 1

Basics

Contents:

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HOW TO USE THIS MANUAL

If you have not worked on an Apple Daisy Wheel Printer (DWP) before --

Read and perform this section, **Basics**, before you do anything else. It will familiarize you with the basic parts and operation of the printer, show you how to run the printer self-tests, and help you perform all the other tasks more quickly.

You can use sections 3 and 4, **Take-Apart** and **Print Quality Adjustments**, as a self-training course, by going through the procedures in order on a printer of your own. Or you can simply use the step-by-step instructions when you need them. However, since the DWP is a complicated mechanism, it's a good idea to practice the procedures before you need to use them.

If you are already familiar with the DWP --

Use Section 2, **Troubleshooting**, as a guide to repairs. The symptom table at the front of **Troubleshooting** lists the general categories of possible problems, and refers you to the appropriate Troubleshooting Table. The Tables tell you how to isolate and repair specific faults.

Sections 3 and 4, **Take-Apart** and **Print Quality Adjustments**, contain step-by-step instructions for the adjustments and replacements recommended by the Troubleshooting Tables. To find a particular procedure, just use the table of contents of the appropriate section.

Preventive Maintenance procedures (cleaning and lubrication) are given in section 5. Sections 6 and 7 contain technical procedures for the **Forms Tractor** and **Sheet Feeder** attachments for the DWP.

Appendix A, the **Illustrated Parts List**, contains exploded diagrams of the DWP modules, along with part numbers of the piece parts available from Apple. All these piece repairs are optional at Level One, but if you choose to replace broken or worn-out parts in your shop, this section will be helpful.

To begin learning how to operate the DWP, turn the page.

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TOOLS AND MATERIALS NEEDED:

NOTE: There have been several revisions of the main PCB and a number of minor mechanical changes (size or type of screws, nuts, etc.) since the DWP was introduced. The tools recommended here should cover most DWPs currently in the field, but do not be surprised if you find variations from printer to printer.

Screwdrivers:	Small flatblade Medium flatblade with narrow head (magnetized) Medium Phillips Small Phillips
Nut drivers:	1/4 inch 5/16 inch
Wrenches:	5/8 inch open-end 1/4 inch box and open-end 11/32 inch box and open-end 5/16 inch box and open-end 3/16 inch box and open-end
Miscellaneous:	0.072 inch six-flute spline wrench 0.001 to .003 inch feeler gauges Needlenose pliers Diagonal cutters Ruler (non-Metric) Crayon or felt marker
Special tools:	Apple Spring Scale and Combination Gauge kit (P/N) Apple Combination Gauge (Apple P/N) **Torx Screwdriver***

* **NOTE:** This Torx driver, used for platen adjustments, is available at this time (10/83) only from the manufacturer and its representatives.

For information, current prices, and local distributors, write or call:

Mountz, Inc.
1080 North 11 St.
San Jose, CA 95112
(408) 292-2214

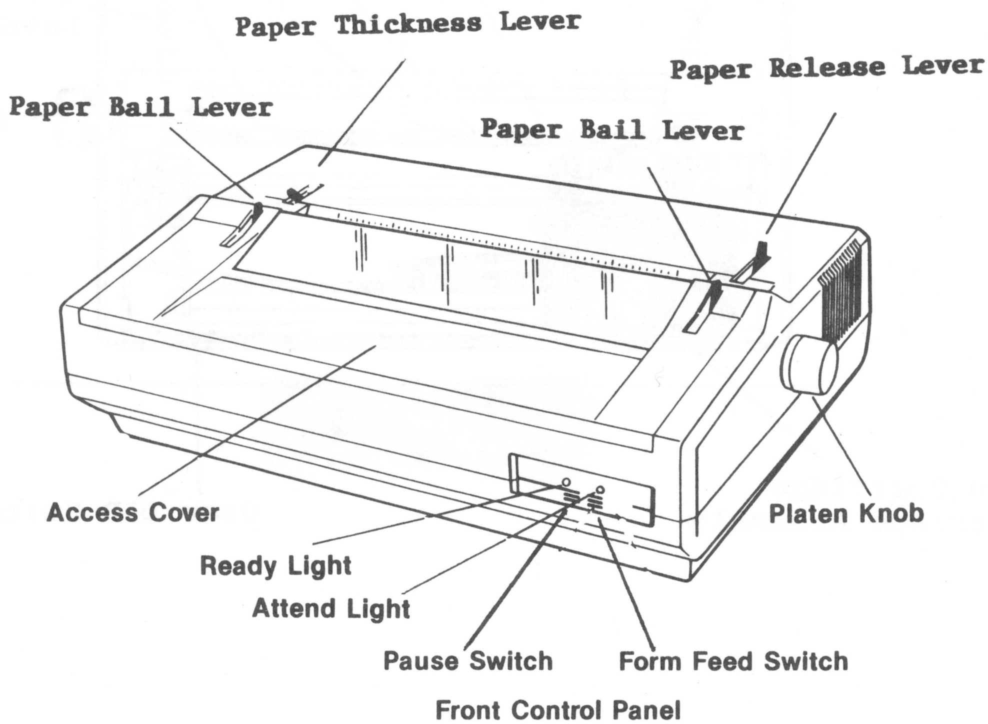
Inquire about **Platen Bit #T15** (P/N 000T15) and **Non-Magnetic Aluminum Shank** (P/N 38958-1).

PARTS OF THE DAISY WHEEL PRINTER

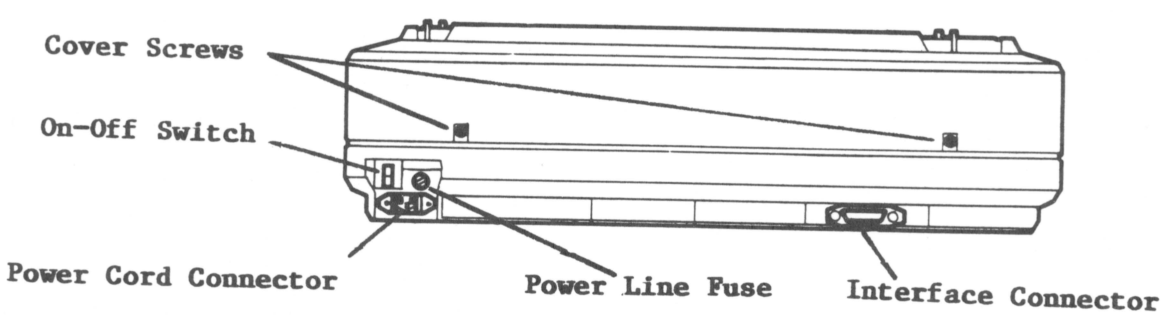
The diagrams on this and the following pages point out the major parts of the DWP and list their names. You can use these diagrams as a guide to the parts referred to in the other sections of this manual.

1. The DWP from the Outside

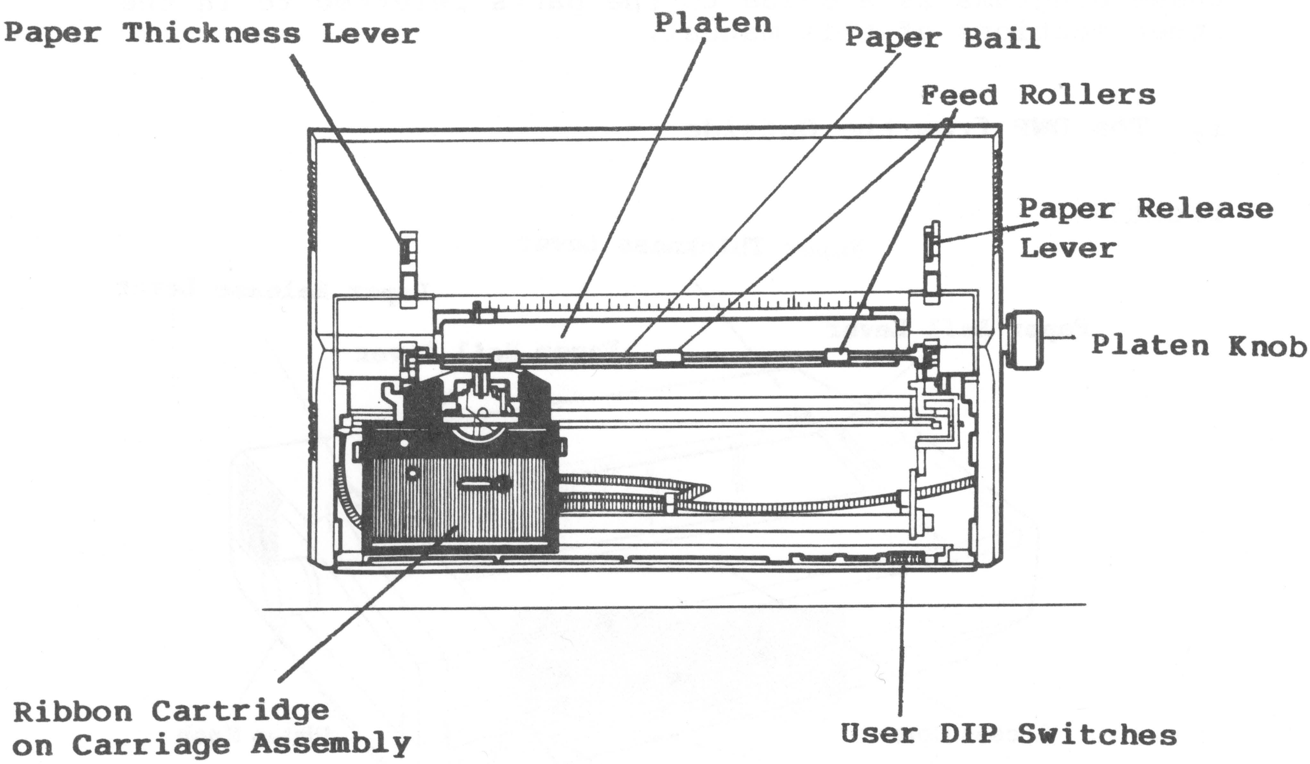
Front:



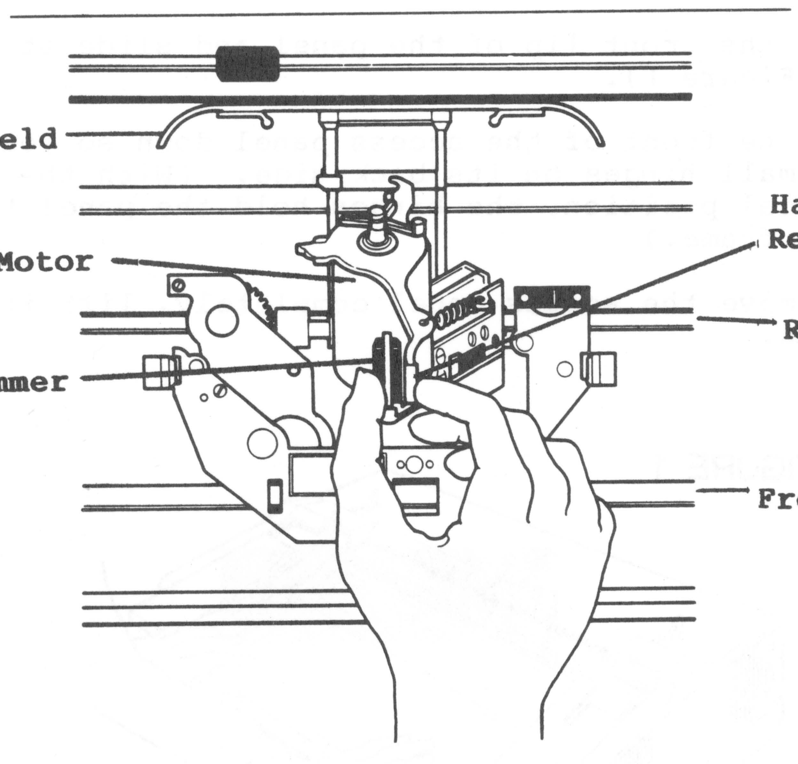
Back:



2. The DWP with the Access Panel Removed



3. The Carriage Assembly (with Ribbon Cartridge Removed)



Removing the Access Panel

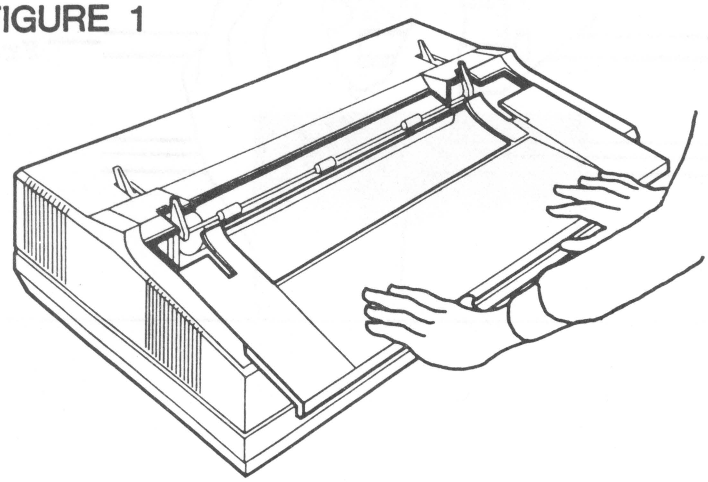
This enables you to reach the printwheel, ribbon cartridge, and user switches.

1. Grasp the front lip of the panel and slide it forward (see Figure 1).

2. Tilt the front of the access panel down so you can see the small hinges on its back side. (With the panel in a vertical position, the hinges hold the panel to the front frame.)

3. To remove the access panel completely, lift it off its hinges.

FIGURE 1



Other User Tasks

Refer to the **DWP User's Manual, Part 1**, for instructions on removing and replacing the ribbon cartridge and printwheel, loading paper, and setting "top of form" position.

IF YOU ARE PERFORMING THESE PROCEDURES FOR PRACTICE, REMOVE AND REPLACE THE PRINTWHEEL AND RIBBON CARTRIDGE, LOAD PAPER, AND SET TOP OF FORM BEFORE PROCEEDING FURTHER.

Replacing the Access Panel

1. Hang the panel, by its hook-shaped plastic hinges, from the front of the printer case.

2. Push the panel forward so that it is level, and gently slide it toward the back of the printer until it is completely closed.

Checking Operation

When you turn the printer on, check the two **status lights** on the front panel. You should see one of the following four conditions:

Ready light steady, **attend light** off: the printer is ready.

Ready light blinks, **attend light** off: the printer is in "pause" mode. Press the PAUSE switch and the ready light should become steady.

Ready light blinks, **attend light** on: normally indicates that access panel is off, or ribbon has run out, or no paper is installed in printer. Check for these conditions, correct if necessary, then press PAUSE. If lights remain in this condition, see **Troubleshooting** section.

Ready light off, **attend light** steady: the printer needs attention. Refer to the **Troubleshooting** section.

If no lights come on, see the **Troubleshooting** section.

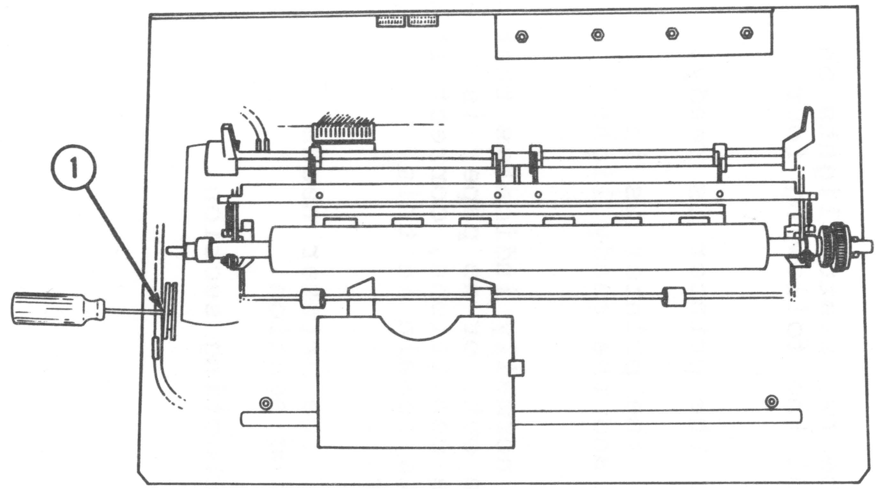


FIGURE 2

```
Software Version  1.6

DIP Switch 1: 11100100    DIP Switch 2: 10010000    DIP Switch FRONT PANEL: 00100001        1 = CLOSED      0 = OPEN

Internal loop back test PASSED

|!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[®]©_•abcdefghijklmnopqrstuvwxyz§¶†™`£¢{\}´˜^¨¡¿ÄÖÜÅÑÆäöüåñéùèàìðæıçß¬•
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|!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[®]©_•abcdefghijklmnopqrstuvwxyz§¶†™`£¢{\}´˜^¨¡¿ÄÖÜÅÑÆäöüåñéùèàìðæıçß¬•
|!"#$
```

FIGURE 3

PRINTER DIAGNOSTICS - SELF-TESTS

There are three self-tests (diagnostics) for the DWP: the Terminal Self-Test and Printer Self-Test are used to check mechanical functioning and print quality; the Terminal Self-Test with External Loop Back is used to check the electronics of the main printed circuit board.

NOTE -- Defeating the Top Cover Interlock Switch: If you have removed the cover for servicing, the self-tests will not normally run, because of an interlock switch at the front left side of the printer. But you can avoid replacing the cover if you defeat the top cover interlock switch as follows: Find the switch housing on the left side of the printer (Figure 2, #1). Push down on the switch lever inside the housing with a screwdriver, and then insert a small Phillips screwdriver through the hole in the switch housing, to hold the lever down.

WARNING: The interlock switch must <u>never</u> be left in the defeated mode. The switch should only be defeated by qualified service personnel during service procedures. **DO NOT DEFEAT THE PURPOSE -- SAFETY -- OF THE INTERLOCK SWITCH.**

Terminal Self-Test -- Print Quality Check

1. Install paper, 11 inches wide (normal paper installed sideways).

2. Inspect the printwheel and ribbon to make sure that they are not defective or worn.

3. Make sure that the paper thickness lever is in the full forward position (toward the operator).

4. Press and hold the PAUSE switch as you turn on the power.

   NOTE: If the cover is off, observe the fan: make sure it is not obstructed by cables, etc.

5. Release the switch and the printer will print a short report of switch settings and internal tests, and then all characters on the print wheel. (See Figure 3.)

6. To stop the test you may:

   turn power off, or

   press and hold the PAUSE switch as the printer nears the end of a line of characters.

CONTINUED ON NEXT PAGE

```
|!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[®]©_°abcdefghijklmnopqrstuvwxyz§¶†™`|
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[®]©_¯°abcdefghijklmnopqrstuvwxyz§¶†™`|!
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[®]©_¯°abcdefghijklmnopqrstuvwxyz§¶†™`|!"
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```

FIGURE 4

7. Inspect the printed characters. All characters, numerals, and symbols should print with equal ink density on their left and right sides, and on top and bottom. The quality of characters should be identical on both sides of the page.

8. If the print quality does not meet these standards, see the **Troubleshooting** section of this manual.

Printer Self-Test

If you have trouble judging side-to-side print quality with the Terminal Self-Test, the Printer Self-Test prints a "barber pole" pattern (Figure 4) that enables you to see how each character prints at each location on the page. To run that test, follow the procedures for the Terminal Self-Test but press the **Form Feed** switch rather than the PAUSE switch.

External Loop Back Test

The external loop back test tests the communications circuitry on the main printed circuit board. If the test passes, the board is good; if not, replace the board.

1. Prepare a Serial Loop-back Connector by jumpering (connecting) the following (female-side) sockets on a standard DB25 connector or a modem eliminator cable:

   sockets 2 and 3, 4 and 5, 20 and 6, 23 and 8.

2. Connect the male side of the Serial Loop-back Connector to the jack on the back of the printer.

3. To start the test, press the PAUSE button while turning the printer on. To stop the test, press the PAUSE button to stop the printer; then press it again, and the printer will print the contents of its buffer and then stop.

This test produces the same printout as the Terminal Self-test, with two exceptions:

a) The fourth line printed will indicate whether the external loop back test passed or failed.

b) The last character printed will be the "status byte," a signal that the printer sends to the host computer (when connected). The status byte tells the host whether the printer is busy or idle, whether Automatic Line Feed is selected or not, etc. For more information, see the Daisy Wheel Printer User's Manual.

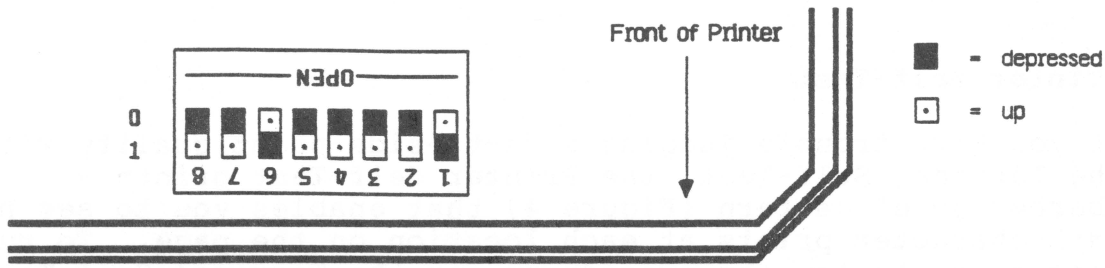


FIGURE 5

Front Panel DIP Switch Configuration

8	7	6	5	4	3	2	1
1: 8 lines per inch	1: Auto LF after CR	Form Length				Type Pitch	
		0000: 3″	0011: 5½″	0111: 8½″	1001: 11⅔″	00: 10 cpi	
		0001: 3½″	0100: 6″	1101: 9″	1010: 12″	*01: 12 cpi	
*0: 6 lines per inch	*0: No auto LF after CR	0010: 4″	0101: 7″	1110: 10″	1011: 14″	10: 15 cpi	
		1100: 5″	0110: 8″	*1000: 11″	1111: 16″	11: PS	

1 = CLOSED, 0 = OPEN, * = factory set

FIGURE 6

apple computer

SETUP TASKS

Setting User Switches

To locate the user-accessible DIP switches, open the access panel and look at the right front corner of the printer. You will see a switch that appears to be installed backwards (see Figure 5). Don't change it: that's the way it should be.

The User DIP Switches control the following functions:

Switch #		Function
8	-	Line Feed (6 or 8 lines per inch)
7	-	Automatic Linefeed after Carriage Return (on or off)
6-3	-	Form Length (from 3 to 16 inches)
2-1	-	Type Pitch (10, 12 or 15 characters per inch or proportional spacing).

The printer reads the switches only when it is first turned on; therefore, if you change the switch settings, you must turn the printer off and then on again to make the new settings operational. To change the settings, refer to the "Front Panel DIP Switch Configuration Chart" on the Reference Card in the User's Manual (or Figure 6), and note the following points:

1. The switches can be depressed on either side with a screwdriver or paper clip. Depressing a switch on the side closest to "OPEN" sets a zero value, while the side having the switch numbers (1 through 8) sets a one value.

2. The switch numbers on the chart correspond to the numbers on the switch: both read left to right, even though the switch looks upside down.

For example, the factory settings of the switches are as follows:

	Value	Setting
Line Feed (number of lines per inch)	6	0
Auto LF after carriage return	OFF	0
Form Length	11"	1000
Spacing (characters per inch, "type pitch")	12	01

The numerical setting of the switches is therefore 00100001, and the switch should appear as in Figure 5.

NOTE: Some software has commands that will override these switch settings; some does not. If a customer is having problems involving form feed length, type pitch, line feed size, or line feeding, check these switch settings.

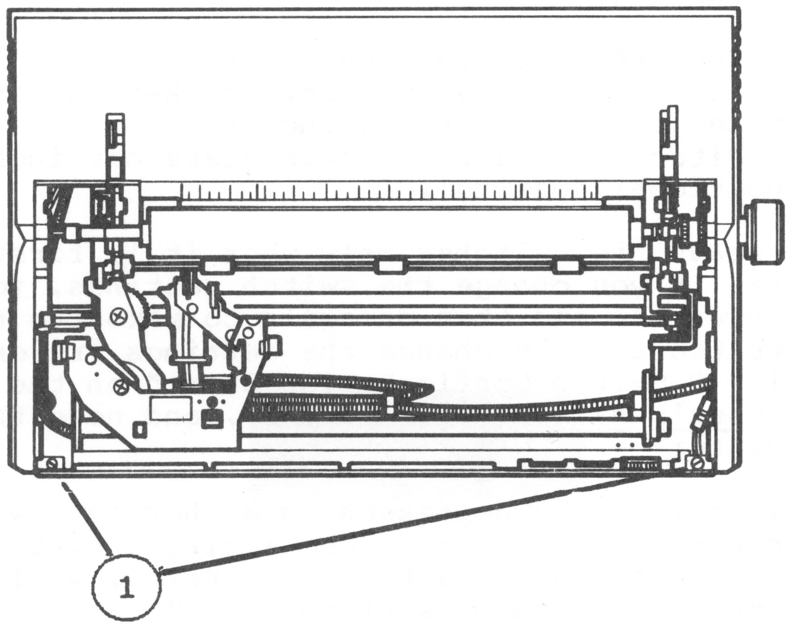


FIGURE 7

Removing and Replacing the Top Cover

To perform Field Service Maintenance, you often need to remove the top cover. But, since the power supply board is not shielded, always make sure the power is off and the power cord is disconnected before you remove the top cover.

1. Turn the printer off and disconnect the power cord.

   WARNING: THE AC POWER CORD MUST BE DISCONNECTED BEFORE THE TOP COVER ASSEMBLY IS REMOVED. LETHAL VOLTAGES ARE PRESENT ON THE POWER SUPPLY PRINTED CIRCUIT BOARD.

2. Remove the access panel.

3. Remove paper.

4. If you had defeated the cover interlock switch with a paperclip or screwdriver, remove the paper clip or screwdriver.

5. Remove the two screws on the rear of the printer.

6. Loosen completely, but do not remove, the two screws near the front of the printer (one on either side) (Figure 7, #1).

7. Pull off the platen knob.

8. Lift the cover.

Replace:

NOTE: If you are doing these procedures for practice, do not replace the cover now, but go to the next procedure.

1. Lower the top cover into place.

2. Tighten the two front retaining screws. Replace and tighten the two rear screws.

3. Return the platen knob.

4. Return the access panel.

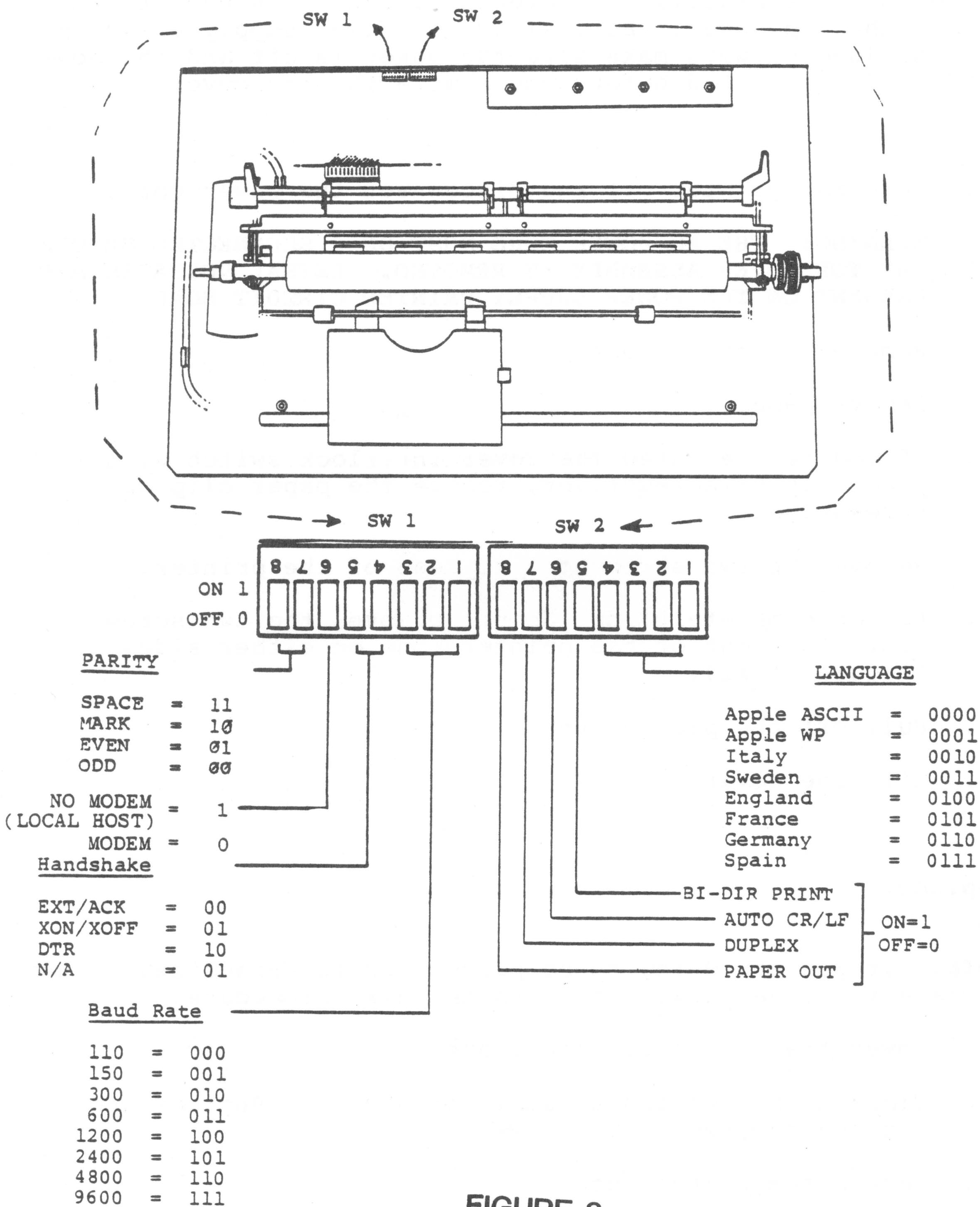

SW 1
SW 2
SW 1
SW 2
8 7 6 5 4 3 2 1
8 7 6 5 4 3 2 1
ON 1
OFF 0
PARITY
SPACE = 11
MARK = 10
EVEN = 01
ODD = 00
NO MODEM (LOCAL HOST) = 1
MODEM = 0
Handshake
EXT/ACK = 00
XON/XOFF = 01
DTR = 10
N/A = 01
Baud Rate
110 = 000
150 = 001
300 = 010
600 = 011
1200 = 100
2400 = 101
4800 = 110
9600 = 111
LANGUAGE
Apple ASCII = 0000
Apple WP = 0001
Italy = 0010
Sweden = 0011
England = 0100
France = 0101
Germany = 0110
Spain = 0111
BI-DIR PRINT
AUTO CR/LF
DUPLEX
PAPER OUT
ON=1
OFF=0

FIGURE 8

Setting Configuration Switches

The two configuration switches are located at the top of the main PCB (see Figure 8). The user is not supposed to set them: as part of an installation, you will set these switches according to the host system specifications and the needs of the customer. Normally the settings will not be changed unless there are technical changes to the host system.

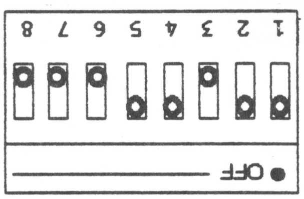
To check the settings, run a Terminal Self-test. The printout will show the switch settings from left to right (switch 8 to switch 1), just as they appear on the physical DIP switches.

1 = ON = switch set toward **rear** of printer
0 = OFF= switch set toward **front** of printer

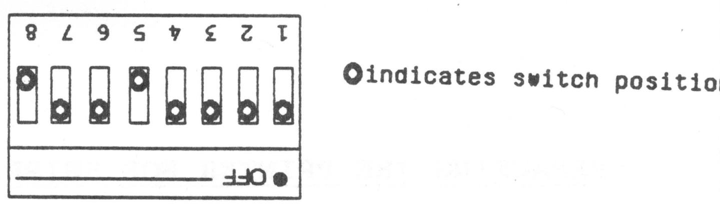
If the printout shows that the switches are set incorrectly, remove the top cover and reset them.

For an Apple][or Apple /// series computer, the settings should be as follows:

DIP Switch 1: 11100100 DIP Switch 2: 10010000



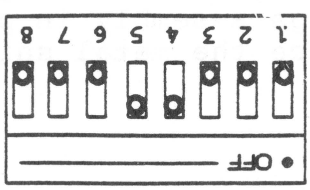
sw 1



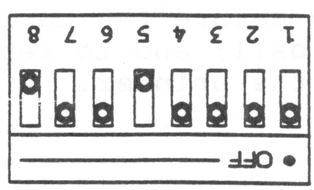
sw 2

For an Apple Lisa computer, the settings should be as follows:

DIP Switch 1: 11100111 DIP Switch 2: 10010000



sw 1



sw 2

For other computers, you must check the computer's manuals to find the proper values for the functions listed below. Then use Figure 8 to set the switches to those values.

Switch	Function	Value	Setting
sw1: 8-7	Parity		
6	Modem		
5-4	Handshake		
3-1	BAUD rate		
sw2: 8	Paper out		
7	Duplex		
6	Auto Linefeed/ Carriage Ret.		
5	Bidirectional Print		
4-1	Language		

REPACKING THE PRINTER FOR SHIPPING

The DWP should always be shipped in the same type of packing it came in. Keep a DWP box and packing materials on hand in case you need to send a whole printer to Apple for Level Two service. Follow the repacking instructions in Part 1 of the **Apple Daisy Wheel Printer User's Manual** (new version, to be published in early 1984), or reverse the unpacking instructions in the older **Apple Letter Quality Printer Operator's Guide** (P/N A2L-0066), pages 2-5. In particular, be sure to remove the printwheel, ribbon cartridge, and platen knob; to secure the carriage assembly in place; to tie down the paper bail; and to replace the metal shipping strap on the base of the printer.

THIS IS THE END OF DWP BASICS.

Apple Daisy Wheel Printer
Technical Procedures

Section 2

Troubleshooting

Contents:

NOTE: The Daisy Wheel Printer should be tested with the Apple II Peripherals Diskette. (See **Multi-Product Diagnostics Technical Procedures, Section 1.**)

Instructions:

Run a Terminal Self-Test (see **Basics**). Examine the printer for the symptoms listed below, and turn to the appropriate table for instructions. Step-by-step instructions for recommended replacements and adjustments can be found by consulting the tables of contents of the appropriate sections.

Symptom		Table	Page
Poor print quality		1	2.2
Prints scrambled text		2	2.4
Will not print			
Check indicator lamps:			
READY "ON"	ATTEND "OFF"	3	2.5
READY "BLINKS"	ATTEND "ON"	4	2.5
READY "BLINKS"	ATTEND "OFF"	5	2.6
READY "OFF"	ATTEND "ON"	6	2.6
READY "OFF"	ATTEND "OFF"	7	2.7
Paper will not advance		8	2.10
Ribbon will not advance		9	2.11

Abbreviations

CA - Carriage Assembly
CM - Carriage Motor
PCB - Printed Circuit Board
PW - Printwheel

TABLE 1

PRINT QUALITY

Except where noted, instructions for adjustments are to be found in Section 4, **Print Quality Adjustments.** Refer to the table of contents of the appropriate section to find the page locations of particular procedures.

Symptom	**Adjustment**
Tops of characters lost or light (evenly across the page)	- check ribbon support plate adjustment - hammer angle (raise rear of hammer) - platen height
Bottoms of characters lost or light (evenly across the page)	- move paper thickness lever forward - check ribbon support plate adjustment - hammer angle (lower rear of hammer) - platen height - platen depth
Print quality poor on one side of the page	- platen depth
Uneven letter spacing (Poor horizontal registration)	- drive belt tension (Sec. 3, **Take-Apart**) - platen locator sleeve
Uneven line spacing (Poor vertical registration)	- If using a forms tractor, check: -installation -paper release lever position -timing belt (see Section 8, **Forms Tractor**) - paper feed idler gear
Missing letters	- check printwheel for missing spokes - hammer penetration

Symptom	Check / Remedy
Light printing	- hammer armature front & rear stops - hammer penetration - replace ribbon - replace print hammer assembly - replace carriage assembly (Sec. 3, **Take-Apart**)
Messy, over-inked printing	- rear stop - hammer penetration
Print quality varies from character to character, line to line	- replace ribbon - clean ribbon shield fingers (Sec. 5, **Preventive Maintenance**) - replace carriage assembly (Sec. 3, **Take-Apart**)
Print quality varies from side to side of a single character	- replace ribbon - clean print hammer (Sec. 5, **Preventive Maintenance**) - replace print hammer

NOTE: Always run a Terminal Self-Test to recheck print quality. Most adjustments will need refinement to achieve optimum print quality.

TABLE 2

PRINTS SCRAMBLED TEXT

Symptom: Prints scrambled text ("garbage").

Corrective Action: Run Terminal Self-Test.

Result 1: Printing is normal.

This indicates that the problem is in the host system, host system software, or communications between the host system and printer (User Switches, Configuration Switches).

Corrective Action:

- o Check host system software for correct driver, filter.
- o Check software settings for agreement with printwheel.
- o Check User Switch settings (see **Basics** Section).
- o Check Configuration Switch settings (see **Basics** Section).
- o Swap host system.

Result 2: Prints scrambled text.

Check the following and correct if necessary, rechecking after each step.

Corrective Action:

- o Check printwheel (bent spokes)
- o Check ribbon shield adjustment (may be rubbing against printwheel)
- o Replace Main PCB
- o Replace Carriage Assembly

TABLE 3

Symptom: Will not print

Condition: READY lamp "ON"
ATTEND lamp "OFF"

This condition shows that the printer should be ready to print.

Corrective Action: Check the following and correct if necessary, rechecking status condition:

- Printwheel in place
- Ribbon cartridge OK (try a replacement)
- Configuration Switch settings (see Setup and Configuration section)
- Disable Switches (HAMmer DIS, PW DIS, CA DIS) on main PCB (upper right corner) - should be off (set to right)
- Host system and interface
- Hammer penetration (if hammer fires but no print appears)
- Hammer OK (inspect; try a replacement)

If the DWP still won't print, follow initialization procedure in Table 7, Result 2.

TABLE 4

Symptom: Will not print

Condition: READY lamp "BLINKS"
ATTEND lamp "ON"

Corrective Action: Check the following and correct if necessary, rechecking status condition:

- Shipping straps removed? (see unpacking instructions)
- Access panel secure?
- Top cover secure?
- Out of paper?
- Out of ribbon?
- Cover Interlock Switch wires attached to wrong poles? (See "Replace Mechanical Assembly" in **Take-apart.**)
- If sheet feeder or forms tractor is attached, check out-of-paper switch and adjust if necessary (see **Sheet Feeder** and **Forms Tractor** sections).

If the DWP still won't print, follow initialization procedures in Table 7, Result 2.

TABLE 5

Symptom: Will not print

Condition: READY lamp "BLINKS"
ATTEND lamp "OFF"

Corrective Action:

- o Printer is in the "pause" mode. Press the "pause" switch for the READY condition.
- o Replace the main PCB
- o If the DWP still doesn't work, return it to Level Two.

TABLE 6

Symptom: Will not print

Condition: READY lamp "OFF"
ATTEND lamp "ON"
Short, audible alarm

Corrective Action: Perform the following steps in order, rechecking for condition after each step:

- o Switch power "OFF", then "ON" again
- o Replace main PCB and recheck lamps
- o Replace carriage motor and CM encoder PCB
- o Replace carriage assembly and PW encoder PCB

TABLE 7

Symptom: Will not print

Condition: READY lamp "OFF"
ATTEND lamp "OFF"

Corrective Action: Listen to hear if fan is operating.

Result 1: Fan not operating

Corrective Action: Perform the following steps in order, rechecking for condition after each step:

- o Check that AC power cord is plugged in.
- o Switch power "OFF", then "ON".
- o Check AC line fuse (see Diagram, p. 2.12).
- o Replace AC power cord.
- o Check power supply PCB fuse (F1) (see Diagram, p. 2.12).
- o Replace power supply PCB.
- o Replace power switch.

Result 2: Fan operating

Corrective Action: Check printer initialization as follows:

1. Switch power off.
2. Remove top cover and defeat interlock.
3. Push carriage assembly to center of printer.
4. Put slack in ribbon cartridge.
5. Rotate printwheel.

CONTINUED ON NEXT PAGE

6. Restore power and watch for one of the following four conditions:

   a. Printwheel rotates - if not, proceed to New Symptom A.

   b. Carriage moves quickly to left side-frame, then slightly right to establish column zero - if not, proceed to New Symptom B.

   c. The ribbon advances slightly to take up slack - if not, proceed to New Symptom C.

   d. If no movement of any carriage assembly component, proceed to New Symptom D.

   If carriage, ribbon and printwheel move correctly but printer still will not print, replace main PCB.

New Symptom: A - No rotation of printwheel

Corrective Action: Perform each of the following steps in order, rechecking for condition after each step:

- o Check PW Disable Switch (Main PCB, upper right corner) - it should be off (set to the right)
- o Check P-9 connection on main PCB
- o Check PW encoder PCB connection
- o Replace PW pico fuse F-2 on main PCB (see Diagram, p. 2.12)
- o Replace main PCB
- o Replace carriage assembly and PW encoder PCB

New Symptom: B - No movement of carriage assembly

Corrective Action: Perform each of the following steps in order, rechecking for condition after each step:

- o Check CA Disable Switch (main PCB, upper right corner)

- o Check P-7 connector on main PCB
- o Check CM encoder PCB connections
- o Replace pico fuse F-1 on main PCB (see Diagram, p. 2.12)
- o Replace main PCB
- o Replace carriage drive motor and CM encoder PCB

New Symptom: C - No movement of ribbon

Corrective Action: Perform each of the following steps in order, rechecking for condition after each step:

- o Check the two connectors under the ribbon cartridge on the ribbon support plate for tight connection
- o Replace ribbon cartridge with known good one and recheck
- o Check connector P-9 on main PCB
- o Replace pico fuse F-3 (see Diagram, p. 2.12)
- o Replace main PCB
- o Replace carriage assembly and PW encoder PCB

New Symptom: D - No movement of any carriage assembly components

Corrective Action: Perform each of the following steps in order, rechecking for condition after each step:

- o Check connector P-8 on main PCB and P-5 on power supply PCB
- o Replace F1 and F2 on power supply PCB (see Diagram, p. 2.12)
- o Replace the main PCB
- o Replace the power supply PCB

TABLE 8

Symptom: Paper will not advance

Condition: READY lamp "ON"
ATTEND lamp "OFF"
Carriage assembly operational

Corrective Action: Perform the following in order, rechecking for condition after each step:

- Set user switches correctly.
- Check connector P-10 on main PCB.
- Check paper feed idler gear adjustment.
- Perform Terminal Self-Test.
  - If Pass, problem is host or interface.
  - If Fail, replace pico fuse F-3 on main PCB (see Diagram, p. 2.12).
- Replace the main PCB.

Symptom: Paper advances, but poor vertical registration

Corrective Action: Perform the following in order, rechecking for condition after each step:

- If using a forms tractor, check installation, paper release lever position, and timing belt tension (see Forms Tractor Technical Procedures).
- Adjust the paper feed idler gear.

Symptom: Paper advances backwards or with chatter

Corrective Action: Perform the following in order, rechecking for condition after each step:

- Check the paper feed idler gear for chatter as gears mesh.
- Check P-10 on the main PCB; it could be backwards or seated on the wrong pins.
- Replace the main PCB.

TABLE 9

Symptom: Ribbon will not advance
Printwheel motor and carriage drive motor operational

Corrective Action:

- o Remove ribbon and initialize to see if ribbon motor is operational.
- o If operational, replace ribbon cartridge and perform Terminal Self-test
- o If non-operational, perform the following, rechecking condition after each step:
  - Replace pico fuse F-3 on the main PCB (see Diagram, p. 2.12)
  - Replace the carriage assembly.

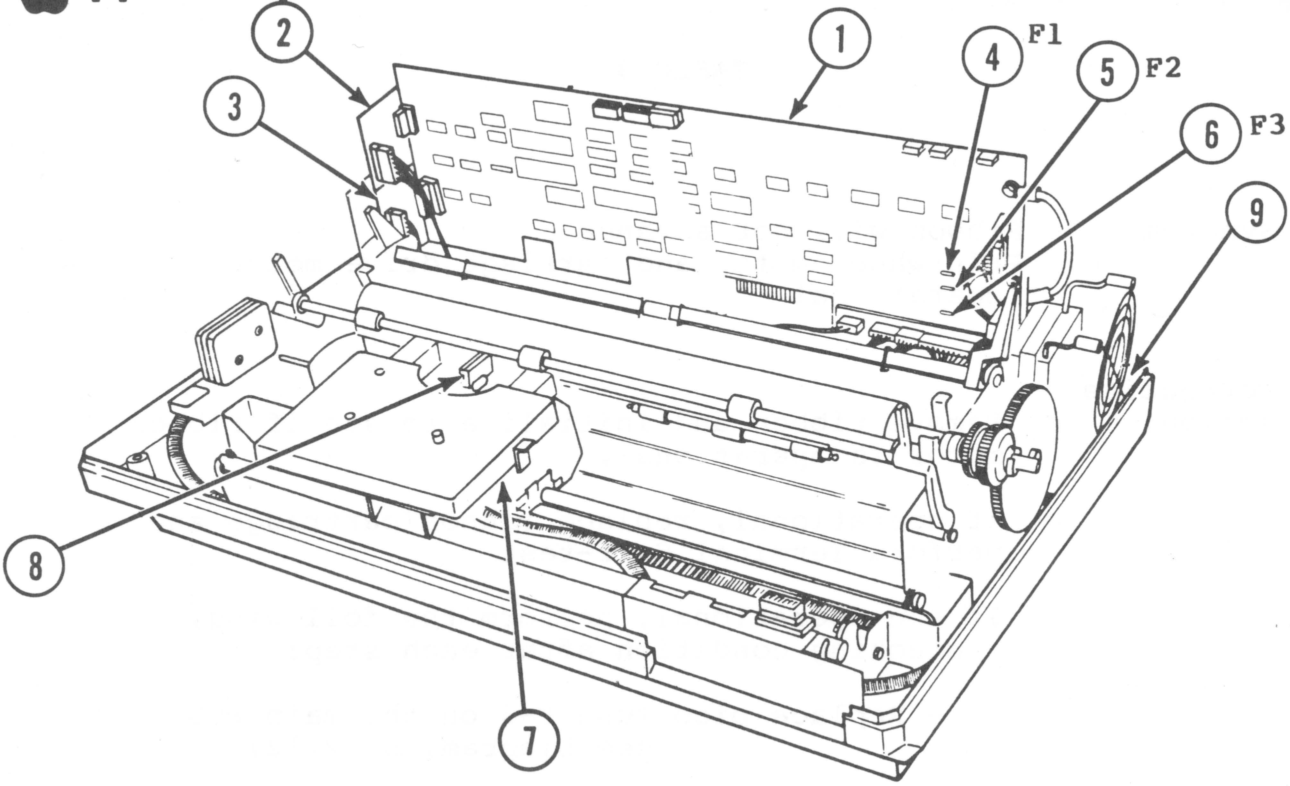


FIGURE 1

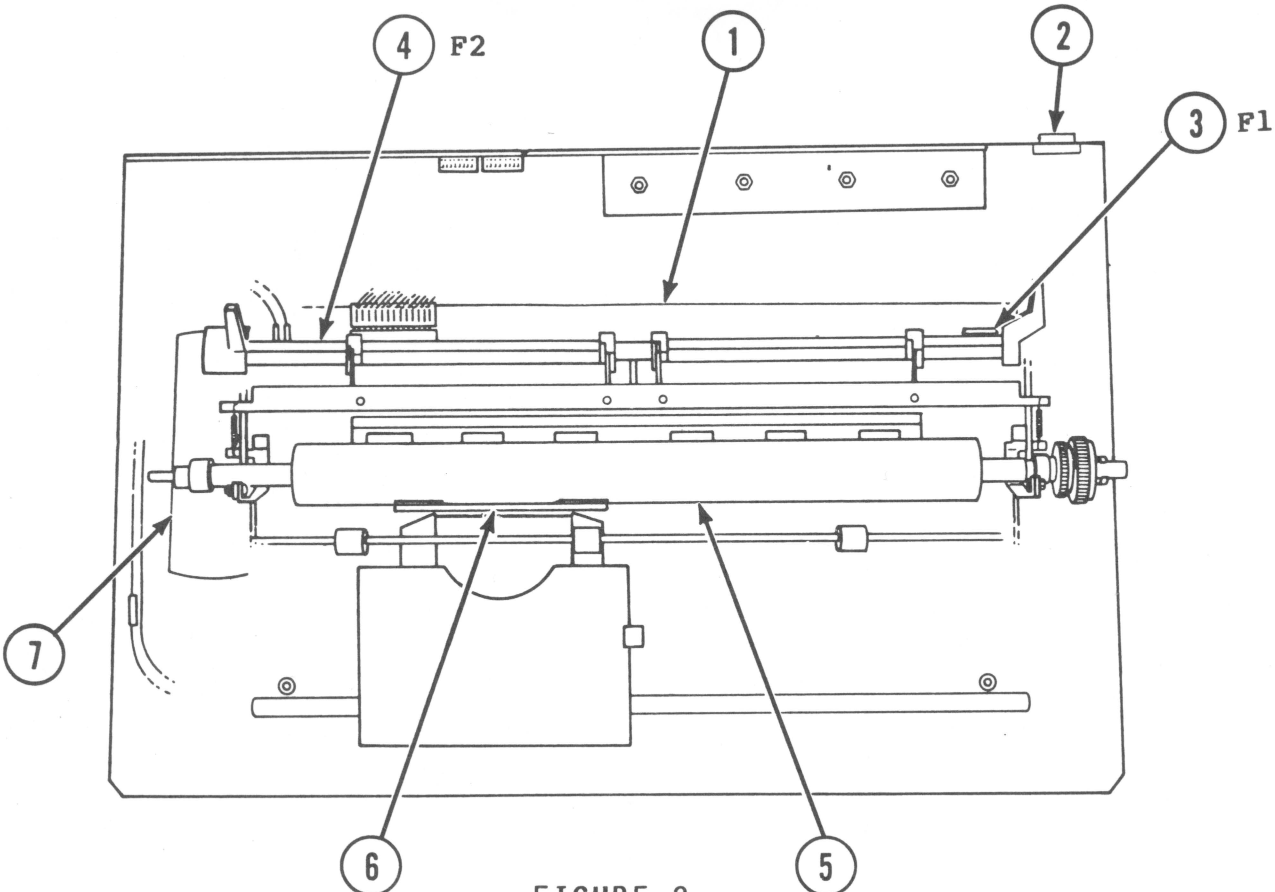


FIGURE 2

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PARTS LIST AND DIAGRAMS FOR MODULE AND FUSE REPLACEMENT

For a complete listing of replaceable parts, see Section 7, **Illustrated Parts List.** The parts listed below are the recommended module replacements for Level One service. The other parts listed in the **Illustrated Parts List** are optional replacements.

Fuses

AC Line Fuse	- 5 amp (Figure 2, #2)
Power Supply PCB Fuses	- F1, 5 amp or, in Europe, JP1, 3 amp (Figure 2, #3) - F2, 5 amp (Figure 2, #4)
Main PCB Pico Fuses	- F1, 4 amp (Figure 1, #4) - F2, 2 amp (Figure 1, #5) - F3, 5 amp (Figure 1, #6)

Mechanical Components

Mechanical Assembly	Figure 1: everything except printed circuit boards and outer case
Carriage Assembly	Figure 1, #7
Print Hammer Assembly	Figure 1, #8
Carriage Drive Motor	Figure 2, #7
Power Switch	Figure 2, #2
Platen	Figure 2, #5
Ribbon Shield	Figure 2, #6

Printed Circuit Boards

Main PCB	Figure 1, #1
Power Supply PCB	Figure 2, #1
Printwheel encoder PCB (replaced with Carriage Assembly)	Figure 1, #2
Carriage Motor encoder PCB (replaced with Carriage Motor)	Figure 1, #3

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Apple Daisy Wheel Printer
Technical Procedures

Section 3

Take-Apart

Contents:

Procedures:

NOTE: If you are using this manual for training, perform only the steps marked with an asterisk (*). By following the marked steps in order, you will completely disassemble and then reassemble the printer with a minimum of duplicated actions.

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IMPORTANT: READ THIS FIRST

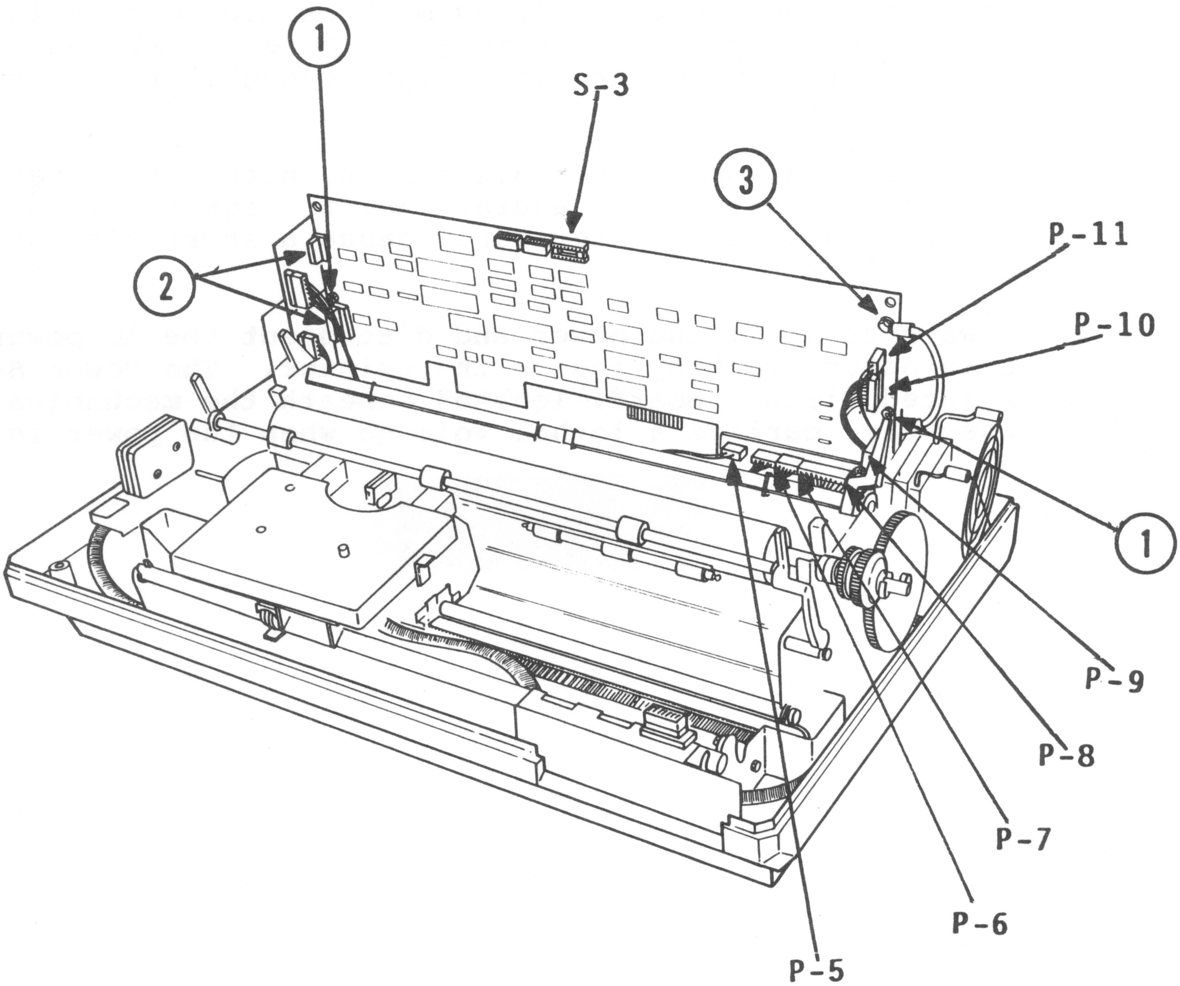
In all the procedures that follow, be especially careful of the following:

1. **DO NOT OVERTIGHTEN SCREWS, NUTS, ETC.:** To avoid stripping and breaking parts of the printer, be sure to tighten screws, etc., **only as much as needed** to hold the adjustment. If you are tempted to give a screw an extra turn "just to make sure it's tight enough," resist the temptation!

2. Make certain you recover all screws, nuts, etc., before turning the printer on again. Any foreign metal object dropped into the printer could cause a short circuit and a lot of damage.

3. **Always turn off the power and disconnect the AC power cord before working inside the printer. The Power Supply Printed Circuit Board, located beneath the mechanical assembly, carries a lethal voltage when the power is on.**

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1 - REMOVE MAIN PCB

Tools required: Medium flatblade screwdriver
Felt pen or marker

There are four printed circuit boards in the Apple DWP. The main PCB is the large board at the rear of the printer. (Two small encoder PCBs plug into the left side of the main PCB; they control the printwheel motor and the carriage drive motor. The power supply PCB is beneath the mechanical assembly.)

*1. Disconnect the AC power cord.

*2. Remove the top cover.

*3. Unplug the ribbon cable from jack S-3 (top center of PCB).

*4. Disconnect the ground wire from the upper right side of the PCB (see Figure 1, #3).

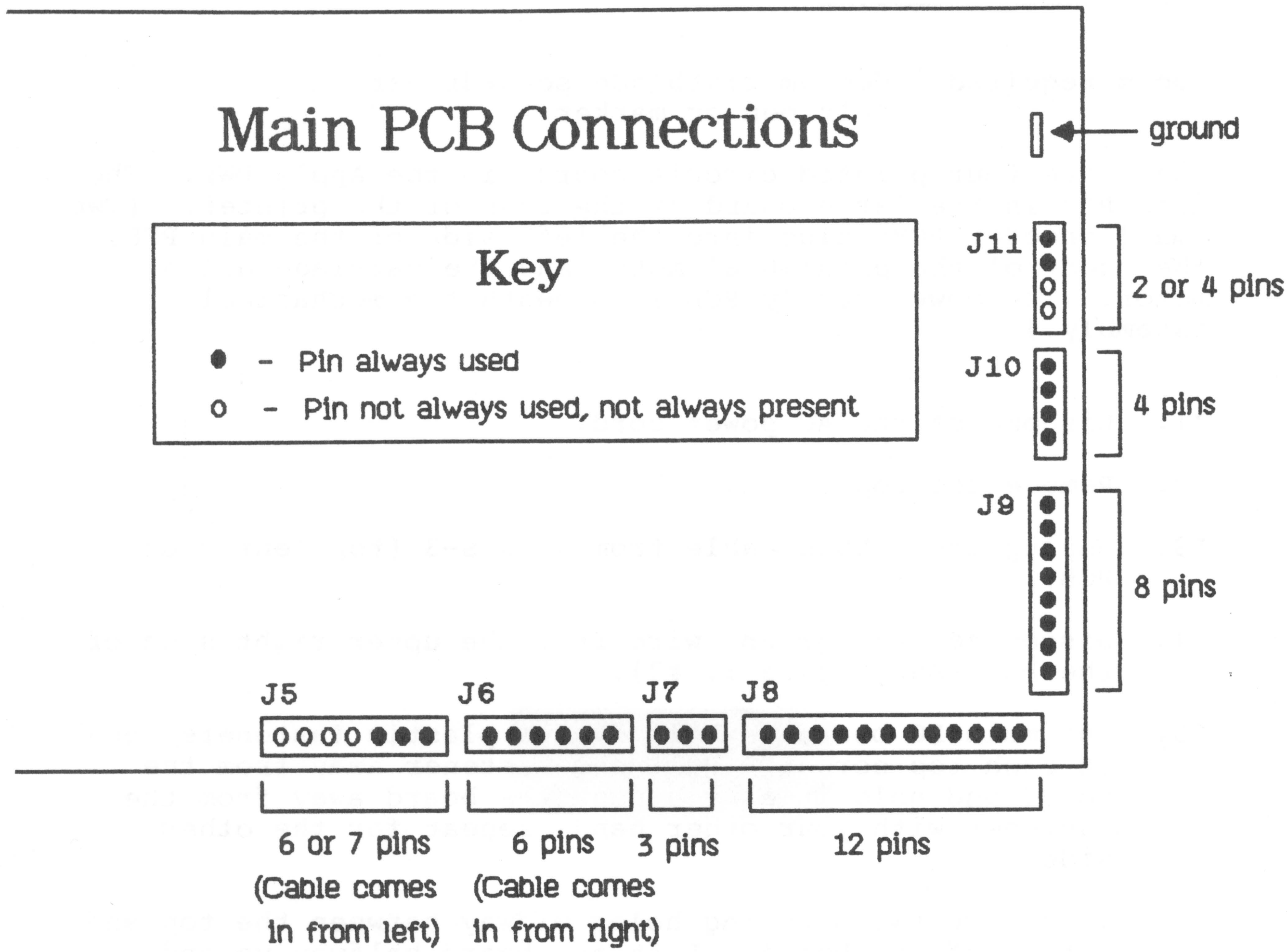
*5. The main PC board is held by two plastic fasteners, one at each top corner. Pull one fastener away from the board and hold it as you push the board away from the fastener with your other hand; repeat for the other side.

*6. There are two mounting holes midway between the top and bottom of the board. Lift the board halfway up and install it on the fasteners using these mid-point holes. (See Figure 1, #1.) If you have trouble raising the PCB, try to free it by pushing with your finger through the RS232 slot on the lower left of the rear panel.

*7. Unplug the two encoder PCBs from the extreme left side of the main PCB. (See Figure 1, #2.)

*8. **Number the cable connectors on the right side of the PCB with the felt pen, according to the P-numbers on Figure 1, so that you will be able to reinstall them correctly.**

CONTINUED ON NEXT PAGE



Connector Assignments

J5 Cover Interlock, Out of paper detect, Forms tractor/sheet feeder connection

J6 Operator Panel

J7 Carriage Assembly Motor

J8 DC Power

J9 Printwheel Motor, Ribbon feed motor, Hammer coil

J10 Paper Feed Motor

J11 Hammer Resistor

FIGURE 2

*9. Mark any empty pins on the jacks (see Figure 2).

NOTE: The cable connections on the main PCB have gone through many revisions, and not all are documented here; so it is important to mark the jacks and connectors before disconnecting anything.

*10. Then remove all the connectors (P11 through P5) from the jacks, **being careful to pull only on the connectors, not on the wires.** (Pulling on the wires can cause bad connections to develop, which creates intermittent problems that are very difficult to troubleshoot.)

*11. Release the main PCB from the fasteners and remove it from the printer.

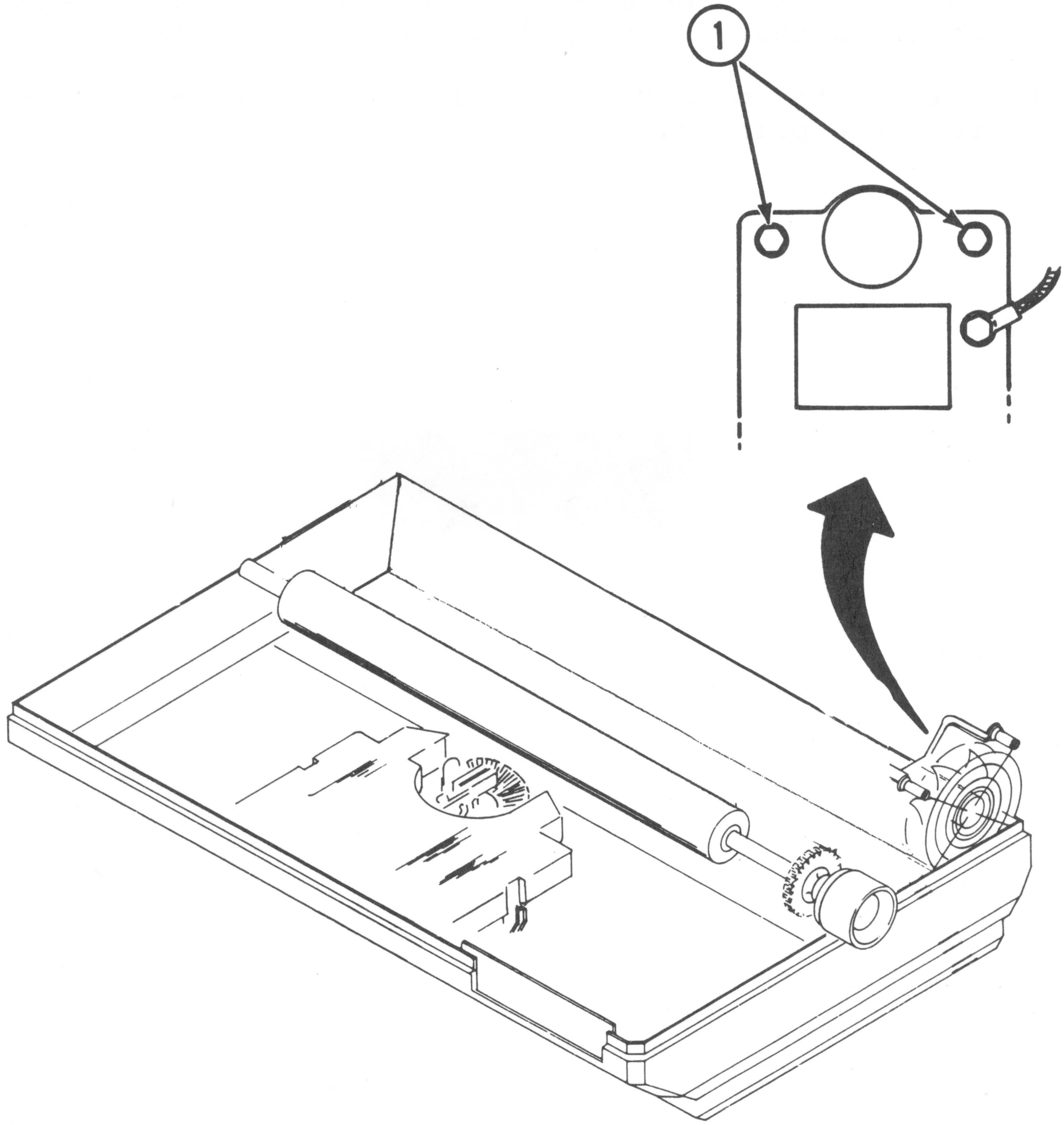


FIGURE 3

2 - REMOVE AND INSTALL POWER SUPPLY SWITCH

Tools required: 1/4 or 5/16 inch nutdriver
1/4 or 5/16 inch wrench
Needlenose pliers
Diagonal cutters
Medium flatblade screwdriver
Felt pen or marker

To Remove:

1. Disconnect the power cord and remove the main PCB (see Procedure 1).

*2. Using a nut driver and a wrench, remove the two screws that hold the fan to its mounting bracket (see Figure 3, #1).

*3. Carefully lift the fan out of the printer as far as its wires permit, keeping hold of both the front and back of the fan, and return the screws to the fan to prevent it from coming apart.

NOTE: If the fan wires are very short, unplug them from their jack on the Power Supply PCB (bottom of printer). Then lift the fan out of the way.

*4. Mark or note the position of the four wires to the power switch; then slide the spade connectors off the power switch. (You may need to use long nose pliers to remove the spade connectors.)

*5. Depress the spring lever (cut the tie wrap if present) at the top of the power switch and push the switch out of the printer.

To Install:

*1. Put the switch in place but leave it loose.

*2. Connect the wires (top wires come from Power Supply PCB; blue wires are toward outside of printer [right side, as you look from the front]).

*3. Push the switch into its socket so that it snaps into place.

*4. Install the fan. **NOTE:** Tighten the screws evenly and check that the fan turns freely. If it does not, the screws are too tight or too loose.

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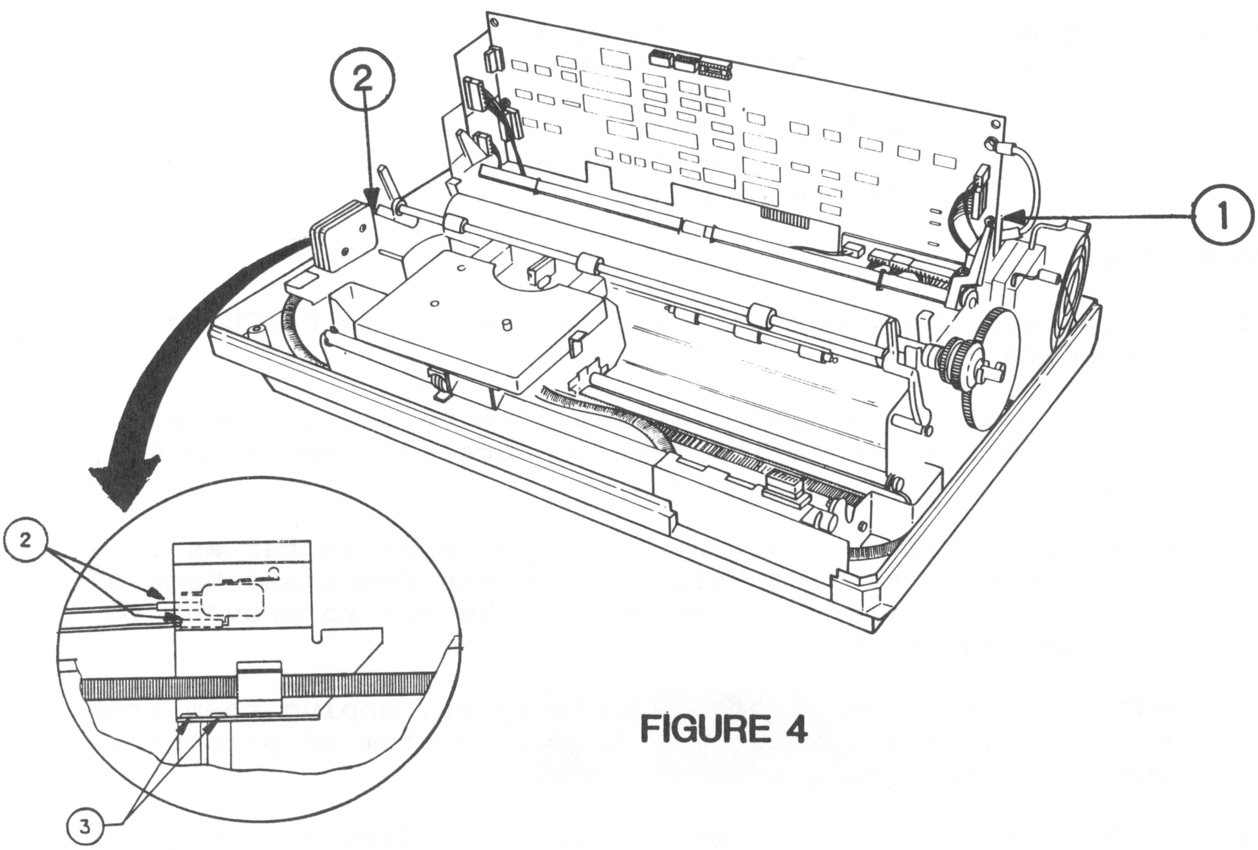


FIGURE 4

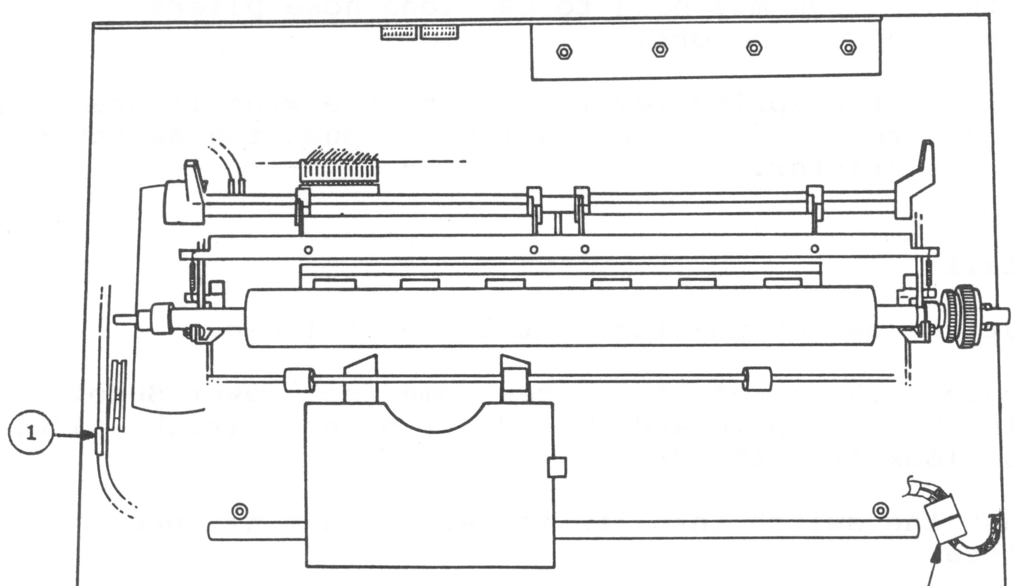


FIGURE 5

IF PRACTICING THIS PROCEDURE FOR TRAINING, SKIP STEPS 5 AND 6 AND GO ON TO PROCEDURE 3.

5. Replace the main PCB (see Procedure 9).

6. Perform Final Check (see Procedure 11).

3 - REMOVE MECHANICAL ASSEMBLY

Tools required: Medium flatblade screwdriver
Needlenose pliers
Felt pen or marker

By **mechanical assembly** we mean the entire printer mechanism, except for the printed circuit boards, the printer case and the fan.

1. Disconnect the power cord and remove the main PCB (see Procedure 1).

*2. Disconnect the ground wire from the back plate of the case (see Figure 4, #1).

*3. Hold the mechanical assembly in place as you remove the four retaining screws on the underside of the printer.

*4. Remove the two spade connectors from the cover interlock switch (Figure 4 and detail, #2), using needlenose pliers or a flatblade screwdriver if necessary.

   NOTE: These cables need not be marked: they are interchangeable. But they must be installed on the correct poles (the lower two poles) of the switch.

*5. Release the harness cable (large silver coil-wrapped cable) from its clamp near the left side-frame. (See Figure 5, #1; this clamp is not present on some printers, however.)

*6. Unplug the harness cable connector from its mate on the right front side of the assembly (see Figure 5, #2).

*7. (Optional but recommended) Remove the two screws that hold the cover interlock switch to the printer case and remove the switch (see Figure 4, detail, #3). (This is not possible on some models of the DWP.)

*8. Lift the mechanical assembly up and out of the printer case, **being careful of the cables on the right side of the frame.**

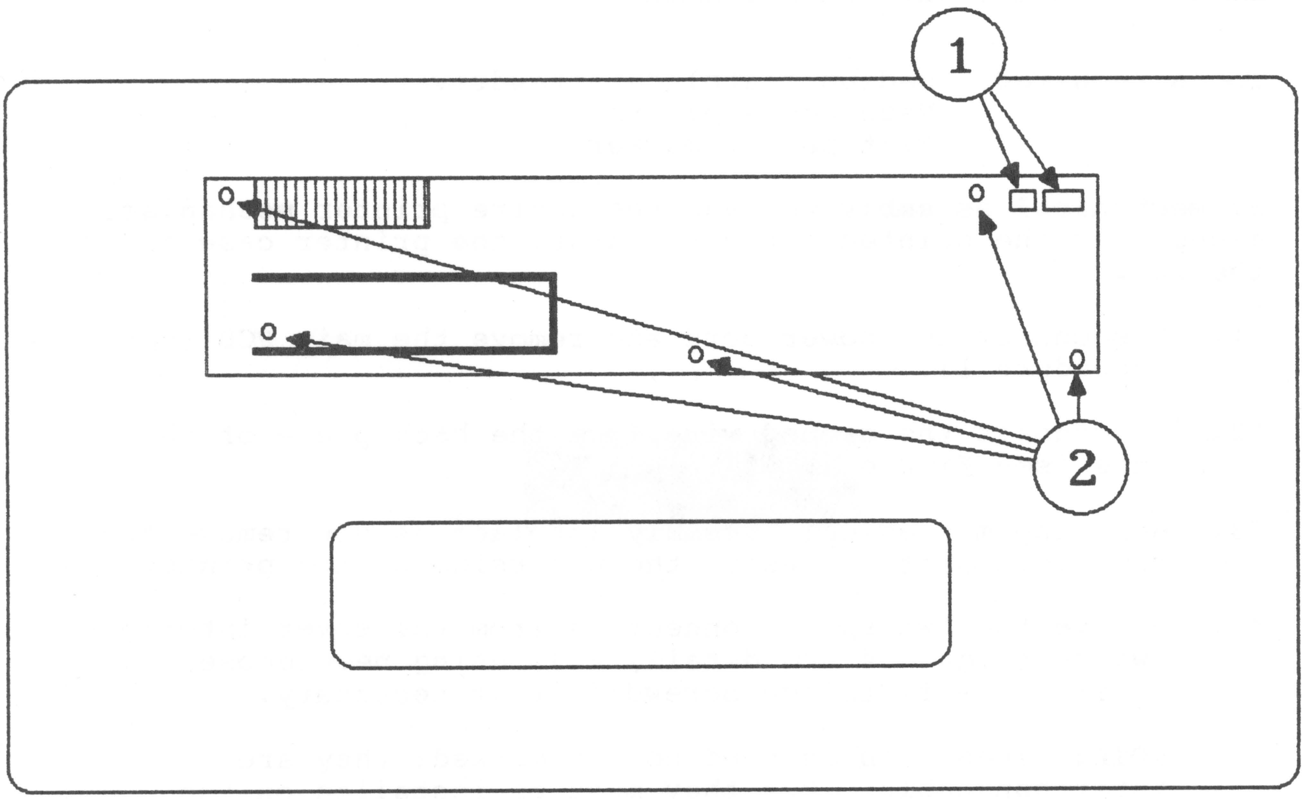


FIGURE 6

4 - REMOVE AND REPLACE POWER SUPPLY PCB

Tools required: Medium flatblade screwdriver
Needlenose pliers
Felt pen or marker

To Remove:

WARNING: ALWAYS DISCONNECT THE AC POWER CORD BEFORE TOUCHING THE POWER SUPPLY PCB. LETHAL VOLTAGE IS PRESENT WHEN THE AC POWER CORD IS CONNECTED.

1. Disconnect the power cord and remove the main PCB (see Procedure 1).

2. Remove the mechanical assembly (see Procedure 3).

*3. Disconnect P-1 and P-2 from the right side of the power supply PCB (see Figure 6, #1).

*4. Five white plastic peg fasteners hold the board down on early versions; on later printers, some of the peg fasteners are replaced by screws. If screws are present, remove them first. (See Figure 6, #2, for positions.)

*5. Free the board from the plastic fasteners by depressing the lip of a fastener (use small screwdriver, needlenose pliers or fingers), then lifting the board slightly off the fastener, and repeating until the board is free.

*6. Lift the power supply PCB from the frame.

To Replace:

*1. Install the power supply PCB on its fasteners. Push down to lock.

*2. Replace screws (if there were screws).

*3. Attach connectors P-1 and P-2 (on right side of power supply PCB) (see Figure 6, #1)

IF PRACTICING THIS PROCEDURE FOR TRAINING, SKIP STEPS 4-6.

4. Reinstall the mechanical assembly (see Procedure 8).

5. Reinstall the main PCB (see Procedure 9).

6. Perform Final Check (see Procedure 11).

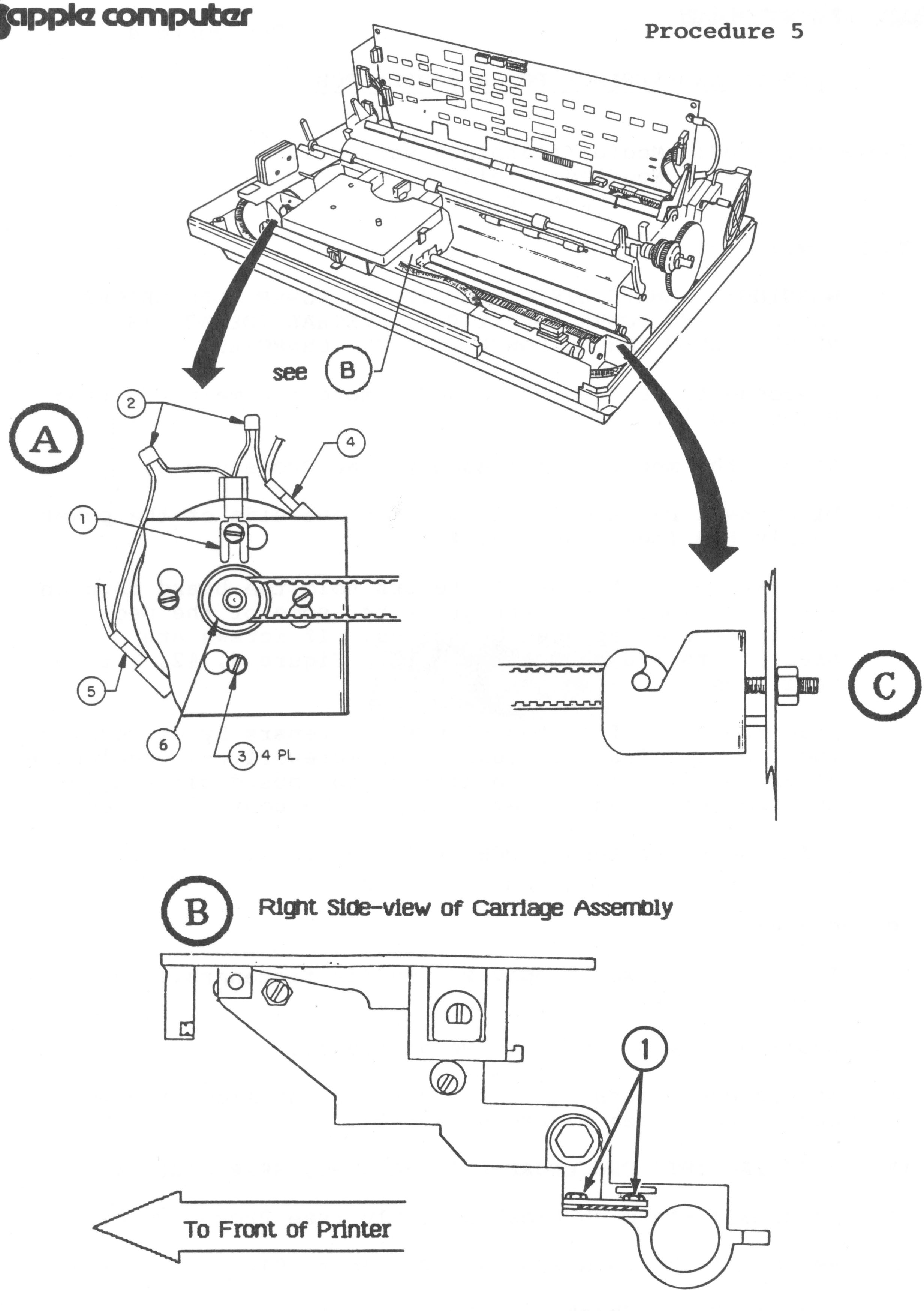

see B
A
1
2
3 4 PL
4
5
6
C
B
Right Side-view of Carriage Assembly
1
To Front of Printer

FIGURE 7

5 - REMOVE AND REPLACE CARRIAGE DRIVE MOTOR

Tools required: Medium flatblade screwdriver
Needlenose pliers
Felt pen or marker
Wrenches: 11/32, 3/16, 1/4 inch
Diagonal cutters
Apple Combination Gauge and Spring gauge
Ruler

To Remove:

1. Disconnect the power cord and remove the main PCB (see Procedure 1).

2. Remove the mechanical assembly (see Procedure 3).

*3. Remove the ribbon cartridge and printwheel (see **User's Manual**).

*4. Push the print hammer assembly back into normal printing position.

*5. Loosen the drive belt by loosening the adjustment nut on the right side (see Figure 7C) with 11/32 inch wrench. (Do not remove nut from screw.)

*6. Remove the drive belt from the right side of the carriage assembly by loosening the two screws holding the belt (see Figure 7B, #1) with a 3/16 inch wrench or small flatblade screwdriver, and then pulling the belt out of its bracket.

*7. Loosen the belt around the motor pulley (Figure 7A, #6).

*8. **CAUTION:** Two small capacitors (Figure 7A, #2) are mounted between the ground wire connector (Figure 7A, #1) and the two spade connectors on the carriage motor. In the following step, **AVOID STRAIN ON THESE WIRES:** it may break the capacitors.

   With a screwdriver or 1/4 inch wrench, loosen the top mounting screw and remove the ground wire connector (Figure 7A, #1).

*9. With a screwdriver and/or a 1/4 inch wrench, loosen the top mounting screw and remove the ground wire connector.

*10. Detach the two spade connectors from the brush mountings on the motor (Figure 7A, #4 and 5). It's easiest to pry them off with a screwdriver, using a twisting motion.

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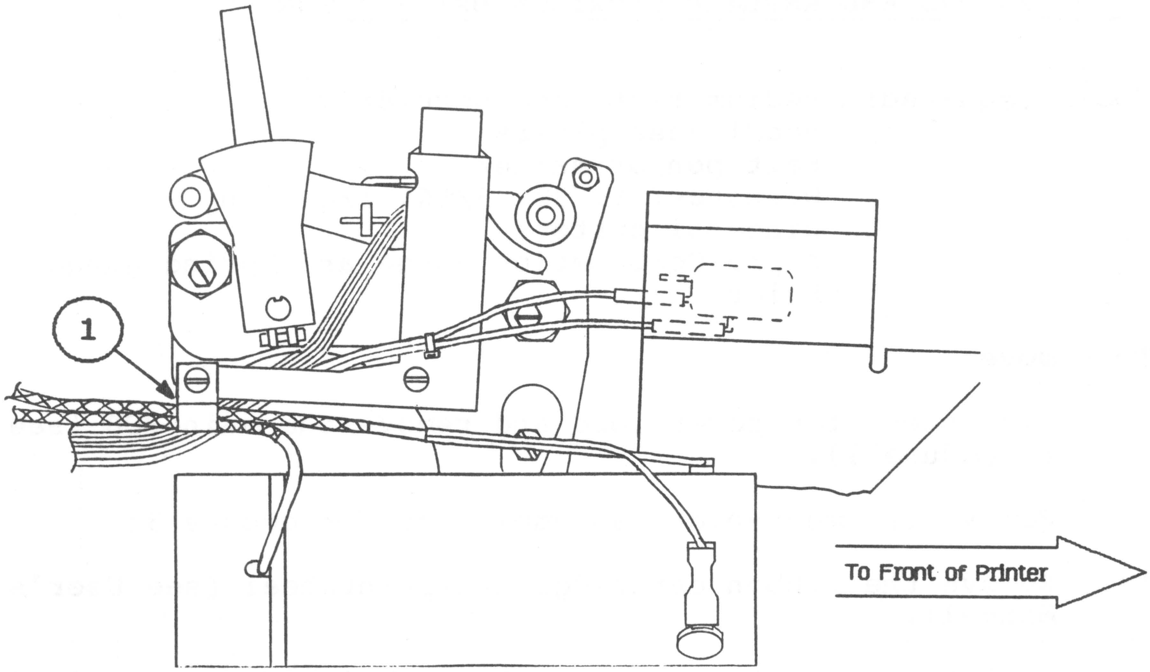


FIGURE 8

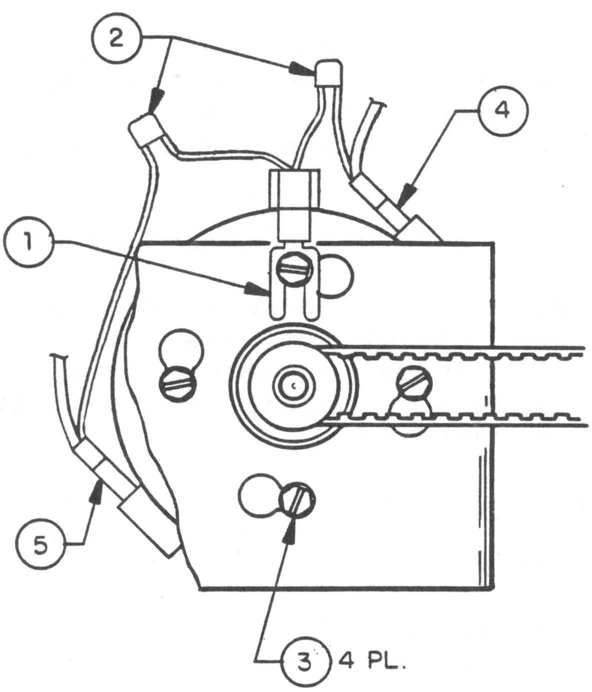


FIGURE 9

*11. On some models, the motor cables are held to the mechanical assembly with a clamp (Figure 8, #1). If yours has this feature, unhook the cables from the clamp.

*12. If the motor cable is clamped to the back shaft of the mechanical assembly with cable ties, cut the ties to free the cable.

*13. With a screwdriver and/or a 1/4 inch wrench, remove the four mounting screws holding the carriage drive motor (see Figure 9, #3).

*14. Remove the carriage drive motor and its encoder PCB.

Note: The carriage motor and encoder PCB are always replaced as a unit. Each encoder PCB is matched to a particular motor by the factory.

To Install New Motor:

*1. Place the carriage drive motor against its bracket on the mechanical assembly (red pole is at 1 o'clock position).

*2. Reposition the ground wire at the top mounting hole of the motor and insert the screw.

*3. Replace and tighten the other three motor-mounting screws. (HINT: Start with the screw at 3 o'clock position and go clockwise. To position the screw at 9 o'clock position, hold it in the box end of the 1/4 inch wrench and lower it into place. Then you can start it with the screwdriver.)

*4. Attach the two spade connectors (black wire to black connector and red to red).

*5. If the motor cables were clamped to the mechanical assembly, replace them in the clamp.

IF YOU ARE USING THIS PROCEDURE FOR TRAINING, SKIP TO PROCEDURE 6.

6. Reroute the drive belt around the motor pulley (see Figure 9). (Make sure that the smooth side of the belt is on the outside and that the belt goes through the slot in the chassis.)

7. Reinsert the drive belt into its bracket on the right side of the carriage assembly as far as it can go, and tighten the two screws that hold it there.

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8. Adjust the drive belt tension (see Procedure 7).

9. **CAUTION:** In this step, watch the cables on the right side of the printer as you lower the mechanical assembly into place. The drive belt adjustment screw tends to catch on these cables and can damage them.

   Reinstall the mechanical assembly (see Procedure 8).

10. Reinstall the main PCB, but leave it in service position (see Procedure 9).

11. Plug the new encoder PCB into the main PCB.

12. Attach the motor cable to the new encoder PCB.

13. Perform Horizontal Registration Test (see Procedure 7a, below) and fine-tune belt tension.

14. Return the main PCB to operating position (see Procedure 9, steps 5 - 8).

15. Perform a Final Check (see Procedure 11).

16. Replace and fasten the top cover and access panel.

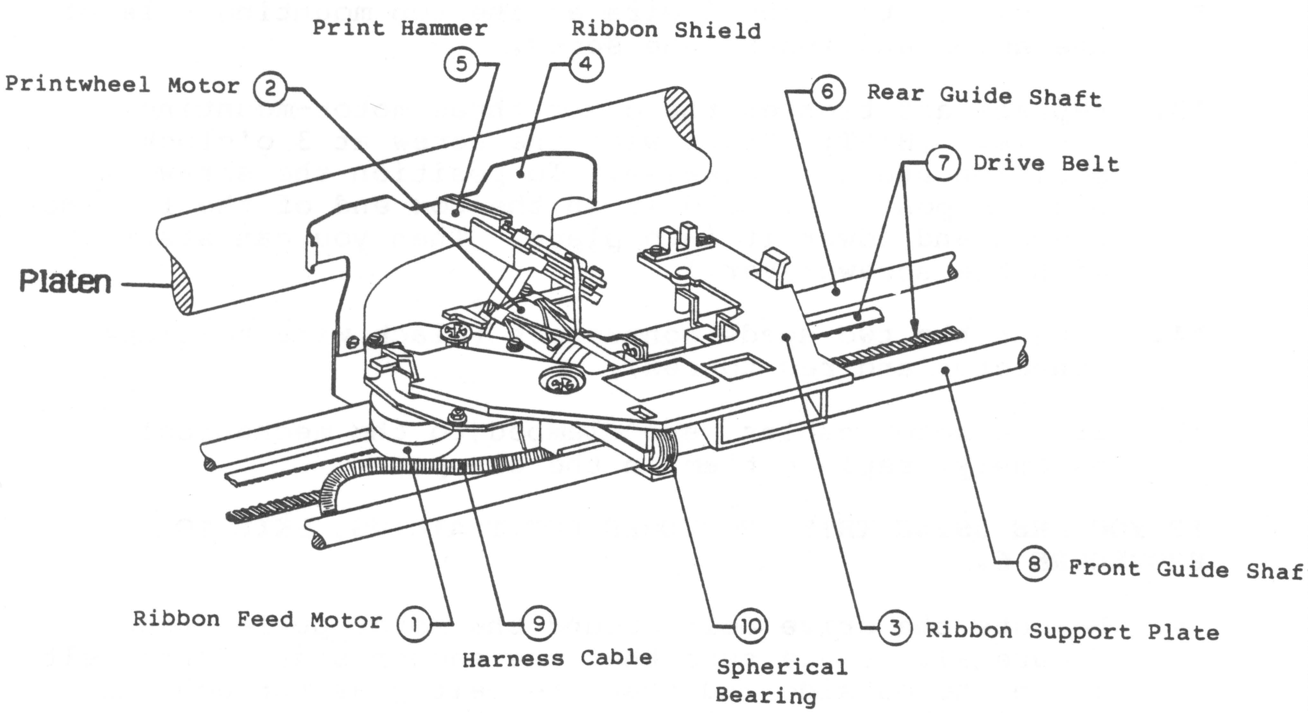


FIGURE 10 - The Carriage Assembly

6 - REMOVE AND REPLACE CARRIAGE ASSEMBLY

Tools required: Medium flatblade screwdriver
Needlenose pliers
Felt pen or marker
Wrenches: 3/16, 1/4, and 11/32 inch
Apple combination gauge
Spring gauge
Ruler

Figure 10 shows the basic components of the carriage assembly: the ribbon support plate (#3), ribbon feed motor (#1), printwheel motor (#2), and print hammer assembly (#5). The print hammer can be replaced by itself (see **Print Quality Adjustments**). If any of the other three parts is faulty, replace the entire carriage assembly.

NOTE: These procedures assume that you will remove the mechanical assembly before removing the carriage assembly. The carriage assembly can be removed and replaced while the mechanical assembly is in the printer, but the procedure is more awkward and difficult.

To Remove:

1. Disconnect the power cord.

2. Remove the main PCB (see Procedure 1).

3. Remove the mechanical assembly (see Procedure 3).

4. Remove the ribbon and printwheel.

*5. So that you will know how the new carriage assembly should look when installed, push the printwheel assembly back into normal position and move the carriage assembly back and forth in the printer to see how it looks and feels, how the harness cable (Figure 10, #9) is routed, and where the three harness cable clamps are placed on the base plate.

*6. The harness cable is held to the base plate by three clamps (left, right and center). Mark the position of the three clamps on the base plate.

*7. Loosen the clamps and free the cable, but leave the clamps attached to the base plate.

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FIGURE 11

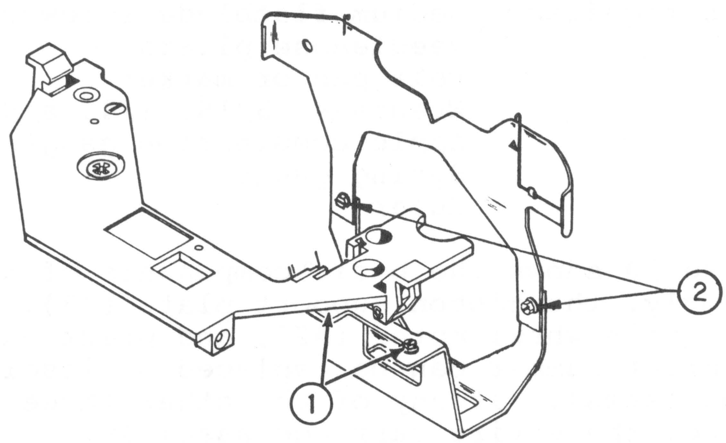


FIGURE 12

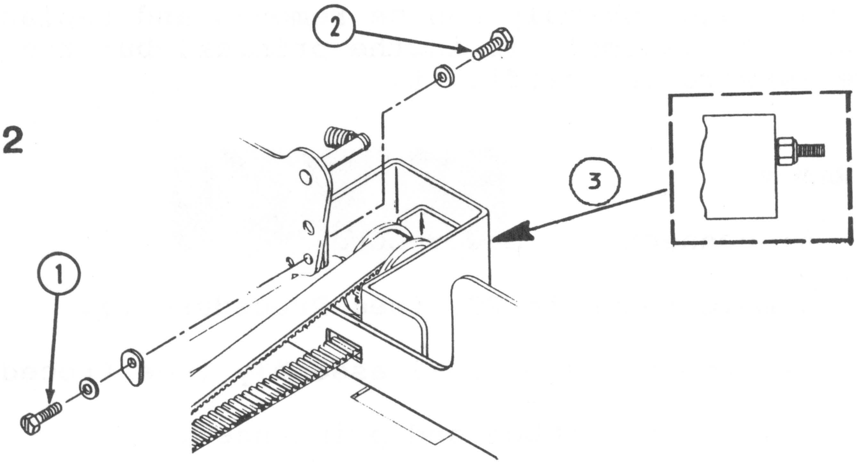
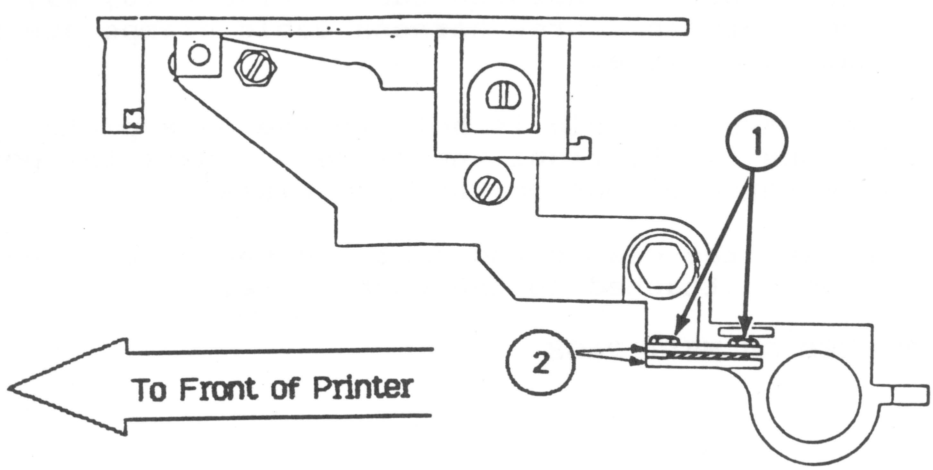


FIGURE 13 Right Side-view of Carriage Assembly



*8. Unplug the encoder PCB from the harness cable and lay it aside.

NOTE: The encoder PCB, which controls the printwheel motor, is "tuned" to this particular carriage assembly at the factory. When you install a new carriage assembly, you must also install the new encoder PCB supplied with it.

*9. Remove the ribbon shield (Figure 10, #4) as follows:

a) Tilt back the print hammer assembly.

b) Remove the two screws that hold the ribbon shield to the carriage assembly (Figure 11, #1).

c) Slide the ribbon shield to one side and lift it out.

NOTE: The printwheel motor is magnetized and may capture the loose screws. If one of the screws is missing, look there first.

10. Loosen the drive belt by loosening the adjusting nut on the right side as far as you can (Figure 12, #3). (Use 11/32 inch wrench.)

11. The drive belt is held to the right side of the carriage assembly by two screws (see Figure 13, #1). Loosen but do not remove the screws, and pull the belt out of the bracket (Figure 13, #2).

*12. The carriage rides on the rear guide shaft (Figure 10, #6). On each side of the rear shaft is a small locking plate that holds the shaft in place (see Figure 12, #1). Mark or note the position of the two locking plates, and then loosen (but do not remove) them.

*13. Use a 1/4 inch box wrench to remove the outer screw on the right side of the frame (see Figure 12, #2).

*14. Slide the carriage assembly all the way to the left.

*15. Remove the rear shaft as follows:

a) Lift the right side of the shaft free of its mounting slot (you may have to push the pulley out of the way).

b) Then pull the shaft out of the assembly completely. If you have trouble, make sure the carriage assembly is as far left as possible.

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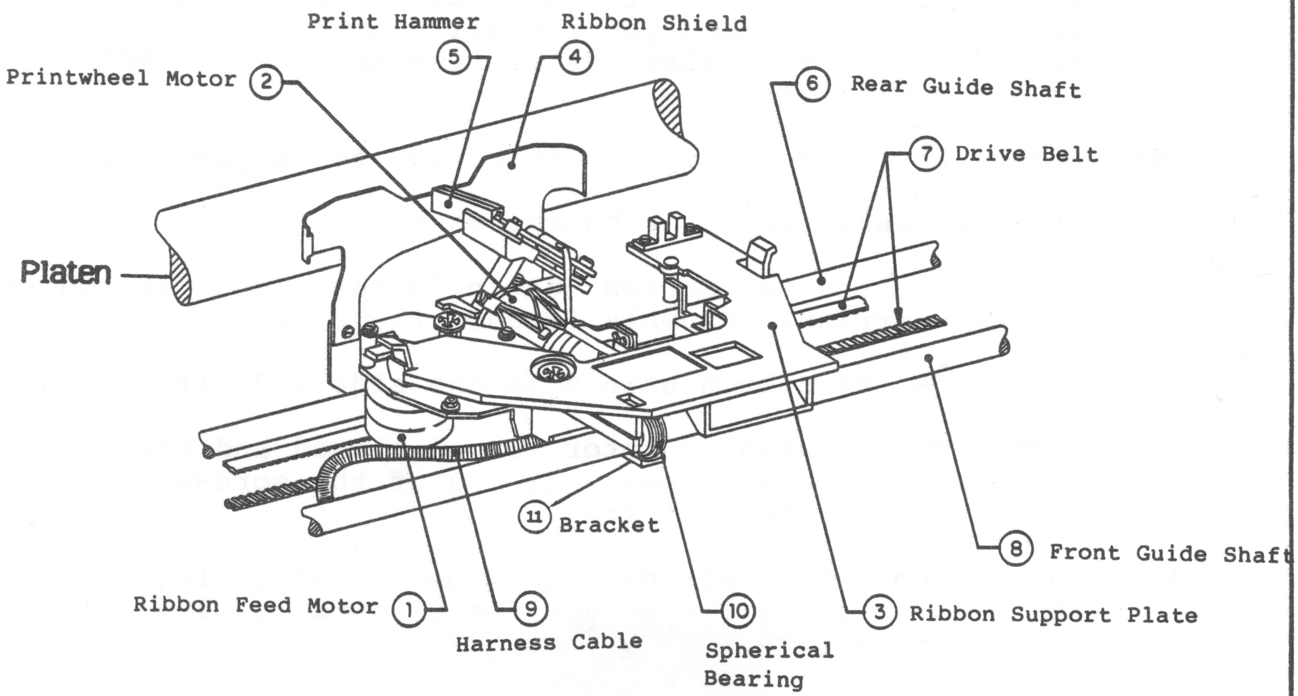

Print Hammer
Ribbon Shield
Printwheel Motor 2
5
4
6 Rear Guide Shaft
7 Drive Belt
Platen
11 Bracket
8 Front Guide Shaft
Ribbon Feed Motor 1
9
Harness Cable
10
Spherical
Bearing
3 Ribbon Support Plate

FIGURE 14

*16. Pull the two ends of the harness cable through the holes in the mechanical assembly.

*17. Pull the drive belt out through the hole in the left side of the frame, so that it is hanging freely from the left side of the carriage assembly.

*18. Free the carriage assembly from the front guide rail shaft by lifting it up and toward the platen. (**CAUTION:** Don't force it! Notice the plastic bracket under the front shaft (Figure 14, #11), which may catch on the shaft if you're not careful.)

*19. Remove the carriage assembly from the printer.

20. With a 3/16 inch wrench, loosen the two screws holding the drive belt to the left side of the carriage assembly and free the belt.

To Install New Carriage Assembly:

1. Insert the drive belt into the left side of the new carriage assembly and tighten the two screws. **Make sure the cleated side of the belt is facing DOWN.**

   CAUTION: Don't overtighten the screws; make sure the belt fits into the cleats of the little bracket on the carriage assembly.

*2. Fit the carriage assembly onto the spherical bearing on the front shaft (see Figure 14, #10).

*3. Route the harness cables so that the cables will cross under the carriage assembly, and push the two connectors through the holes in the mechanical assembly.

*4. Slide the carriage assembly as far left as possible.

*5. Insert the rear shaft through the carriage assembly and into the left side hole.

*6. Push the right side of the shaft into its slot (a pushing/rolling motion works best).

*7. Notice the C-clamps at the right end of the rear shaft. Make sure that the open part of the C-clamps points down.

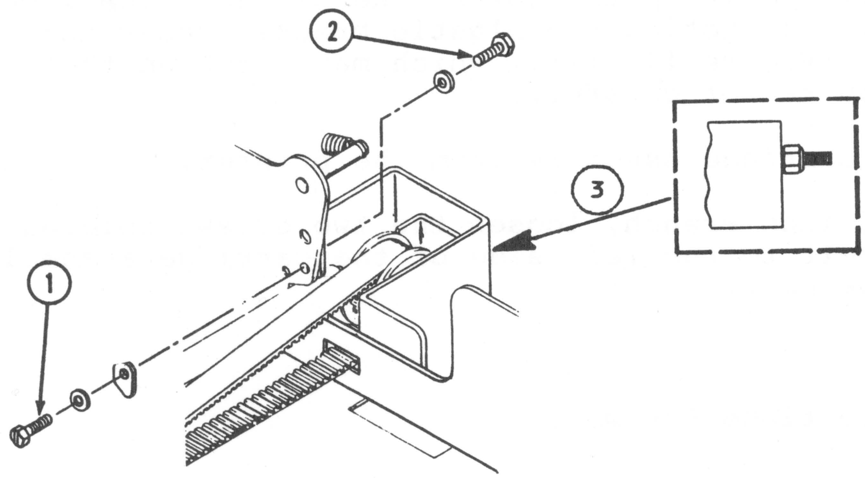


FIGURE 15

*8. Replace the outer screw and washer (Figure 15, #2). **DO NOT OVERTIGHTEN!**

*9. Reposition the two rear shaft locking plates, making sure they butt against the shaft, and tighten the screws (see Figure 15, #1).

*10. Reroute the drive belt: over the pulley on the left side, through the slot in the left side of the frame, across to the right side, through the slot, and around the right pulley (see Figure 15). (Reinstall the right side pulley if it has come out of its slot, making sure that the pulley has a flat brown thrust washer on either side.)

*11. Insert the right side of the drive belt into the carriage assembly as far as it will go, and tighten the two screws.

*12. Tighten the drive belt adjusting nut (Figure 15, #3) to take up some of the slack, but do not make the belt taut: if it is taut, the carriage assembly will not move.

*13. Reroute the harness cable under all three clamps on the base plate, and screw down the clamps.

*14. Tilt the printwheel motor assembly back to normal printing position and run the carriage assembly back and forth to check for free run and noninterference with the harness cable. Adjust or reroute the cable if necessary.

*15. Reinstall the ribbon shield as follows:

a) Tilt the print hammer assembly away from the platen.

b) Slide the ribbon shield into place.

c) Reinstall the two screws but leave them loose.

*16. Adjust the ribbon shield depth (see Procedure 10: Depth only, p. 4.34).

*17. Reinstall the printwheel and ribbon.

*18. Adjust the drive belt tension (see Procedure 7).

*19. Reinstall the mechanical assembly (see Procedure 8).

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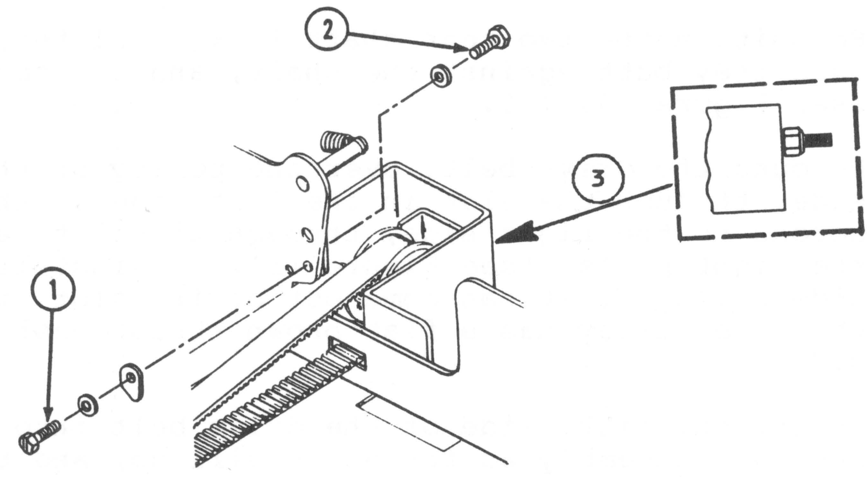


FIGURE 16

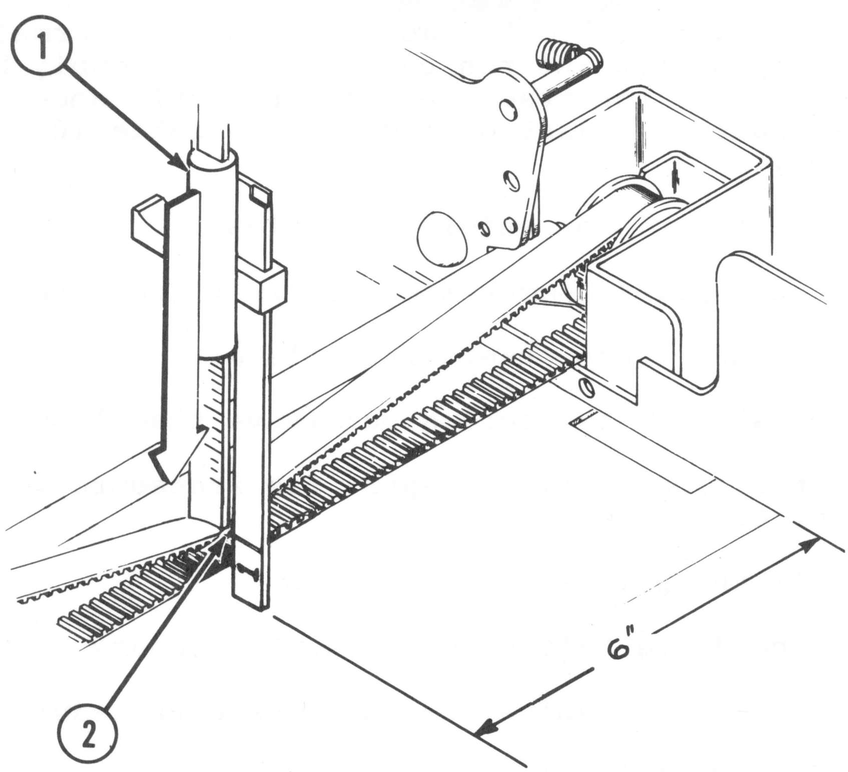


FIGURE 17

*20. Put the main PCB in service position and reinstall the wires (see Procedure 9, steps 1-4). Make sure to install the **new** encoder PCB that comes with the new carriage assembly.

*21. Defeat the cover interlock switch (see **Basics**) and perform the Terminal Self-Test to verify that the new carriage assembly works. If you hear scraping, check the harness cable: if the cable loops near the carriage are too large, they will interfere with carriage motion.

*22. If the carriage assembly works properly, lower the main PCB to operating position (see Procedure 9, steps 5-8.)

23. Perform the Horizontal Registration Test (see Procedure 7a, below) and fine-tune the belt tension.

24. Perform a Final Check (see Procedure 11).

7 - ADJUST DRIVE BELT TENSION

Tools Required: 11/32 inch wrench, Apple combination gauge, Spring gauge, Ruler

*1. Turn the drive belt adjusting nut (Figure 16, #3) clockwise until the belt is fairly taut.

*2. Move the carriage assembly to the far left side of the frame.

*3. Use a pen to mark a line on the belt six inches from the right side of the frame (see Figure 17).

*4. At this same point on the drive belt, place the combination gauge so that the side marked "1" is resting on the base plate of the chassis (see Figure 17).

*5. Use a spring scale to push directly down on the marked point on the drive belt with one pound of force (see Figure 17, #1). With the combination gauge resting on the bottom structure, the lowest scribe line on the gauge should be even with the top of the belt (see Figure 17, #2).

*6. If the drive belt is too loose, turn the adjusting nut clockwise; if too tight, turn the nut counterclockwise (see Figure 16, #3).

CONTINUED ON NEXT PAGE

*7. After altering the drive belt tension, move the carriage assembly back and forth several times; then check again for correct tension and adjust if necessary (Steps 2-6).

8. To fine-tune the drive belt tension (and therefore the horizontal registration), perform the Horizontal Registration Test below and tweak the adjusting nut until results are optimum. This is particularly important if the DWP is being used for graphics, as it might be in a Lisa system.

7a - HORIZONTAL REGISTRATION TEST

This test helps you fine-tune the drive-belt tension by making any horizontal registration problems easy to see.

To run this test, you need an Apple ///, Apple Writer ///, and familiarity with Apple Writer ///.

1. Connect the printer to an Apple ///, using an RS232 cable and a modem eliminator cable.

2. Install paper 14 inches wide (or use two sheets of 8 1/2 by 11 inch paper, overlapping them so as to cover the entire platen.)

3. Boot Apple Writer /// in the Apple and press <RETURN> twice to obtain a blank screen.

4. Type the following embedded commands, starting each at the very beginning of a line:

   (**NOTE:** Each line below starts with two **letters**. The characters that follow the letters are **numbers** (except for ".PRINTER"). Make sure you type the numerals **1** and **0**, not lower-case L and capital O.)

   .LM0 <RETURN>

   .PM0 <RETURN>

   .RM133 <RETURN>

   .LI0 <RETURN>

   .PD.PRINTER <RETURN>

   .CR1 <RETURN>

5. Type the vertical line character | at columns 1, 64, 68, and 132; type <RETURN>.

6. Reproduce that "paragraph" at least 15 times in succession. (You are creating a file that will print straight vertical lines at columns 1, 64, 68, and 132. The more times you reproduce the "paragraph", the longer the lines will be, and the easier to check for registration problems.)

7. To print the file, hold down **<CONTROL>** while typing **p**.

8. A prompt line will appear at the bottom of the screen saying **[P]rint/Program:**.

   Type:

   np

   <RETURN>

9. If the lines are straight, the horizontal registration is good; if they are not straight, adjust the drive belt tension and try the test again.



Loose Belt



Well-adjusted Belt

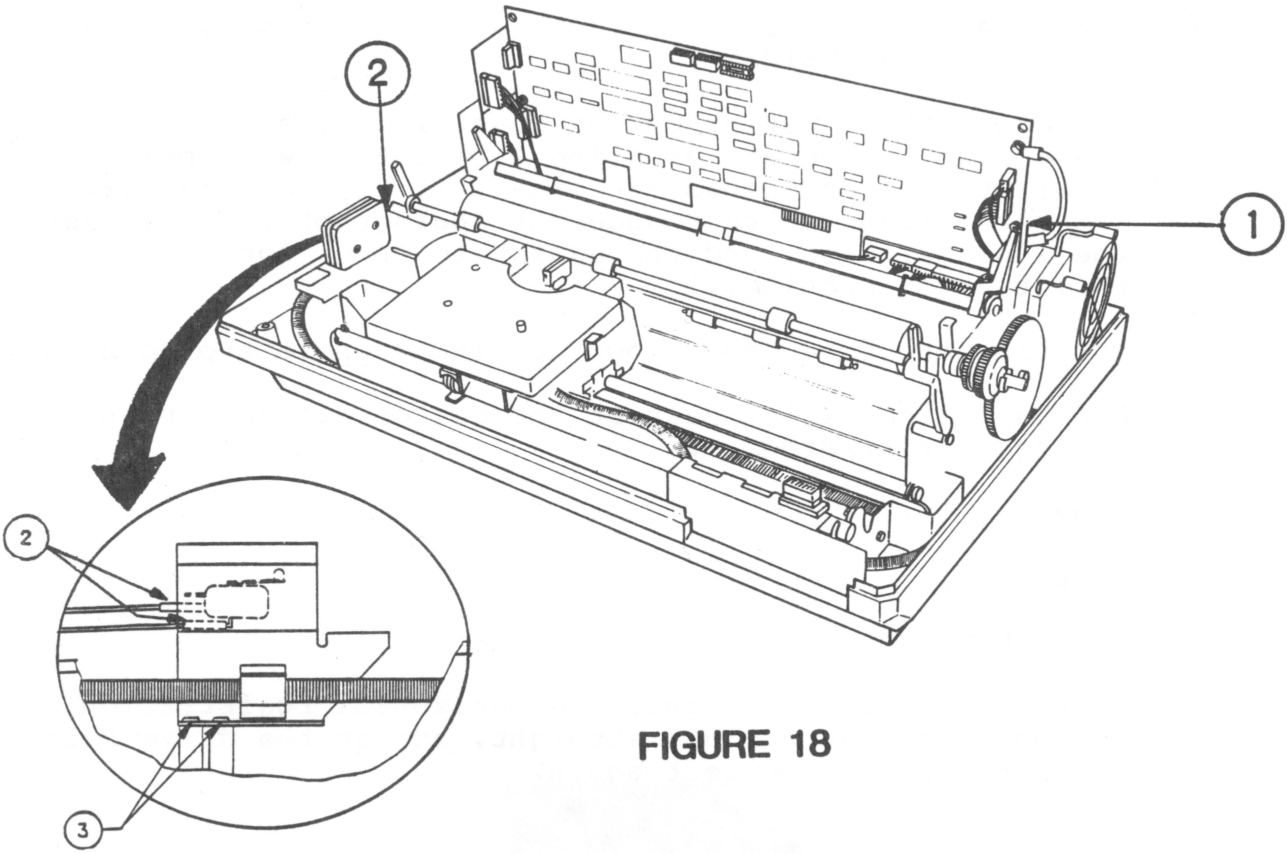


FIGURE 18

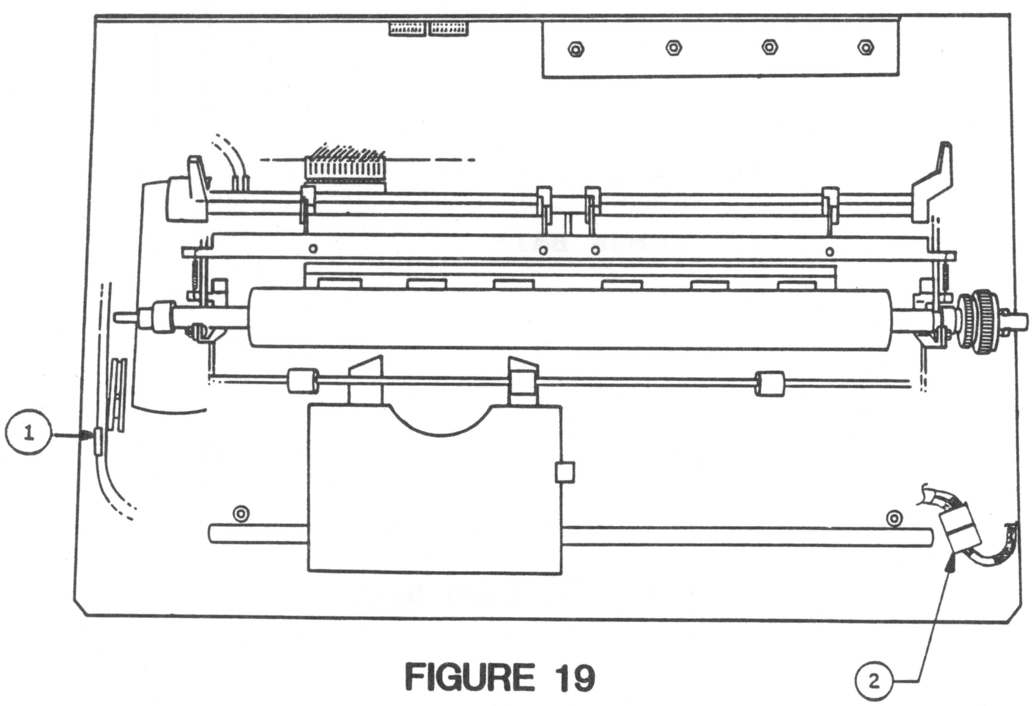


FIGURE 19

8 - REPLACE MECHANICAL ASSEMBLY:

CAUTION: WATCH THE CABLES ON THE RIGHT SIDE OF THE FRAME AS YOU REPLACE THE ASSEMBLY. The drive belt adjustment screw at the right side of the mechanical assembly often catches on these cables and can easily damage them.

*1. Several loose cables lie along the right front side of the case. Make sure they are clamped or taped close to the side of the printer, to avoid damage from the drive belt adjustment screw on the mechanical assembly.

*2. Slowly lower the mechanical assembly onto the frame. If you removed the cover interlock switch earlier, you can lower the right side of the assembly first: that will help you avoid catching the cables on the drive belt adjustment screw.

*3. If you removed the cover interlock switch, reinstall it.

*4. Reconnect the two spade connectors to the cover interlock switch (Figure 18 and detail, #2). Remember that the upper pole of the switch is not used; the connectors attach to the lower two poles.

*5. Reconnect the right side of the harness cable to its mate. (Make sure the two sides are correctly aligned: there are different versions of the connector, but there is always an obvious key.)

*6. Reconnect the left side of the harness cable to the Printwheel Encoder PCB (the lower of the two encoder PCBs).

NOTE: If the Encoder PCB has more pins than the harness cable connector has sockets, examine the connector: there will always be some obvious key to proper installation.

*7. Slip the harness cable into its clamp on the left side of the frame (see Figure 19, #1).

*8. Reconnect the ground wire to the back of the case, behind the main PCB (see Figure 18, #1).

*9. Return and tighten the four long screws on the underside of the printer. (You can line up the screw holes in the mechanical assembly with the holes in the frame by looking down through the mechanical assembly holes.)

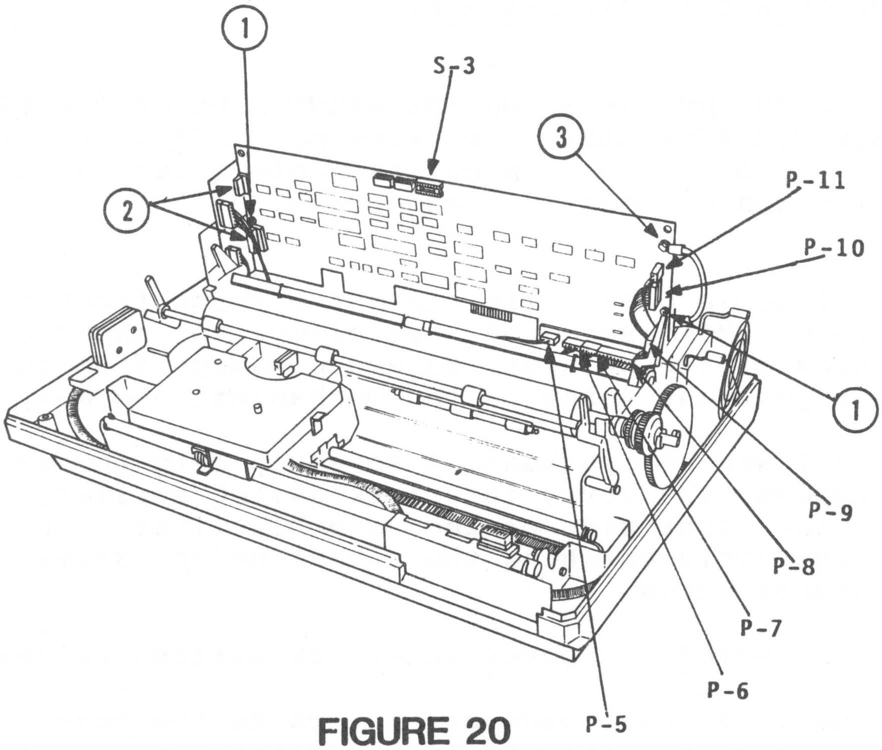


FIGURE 20

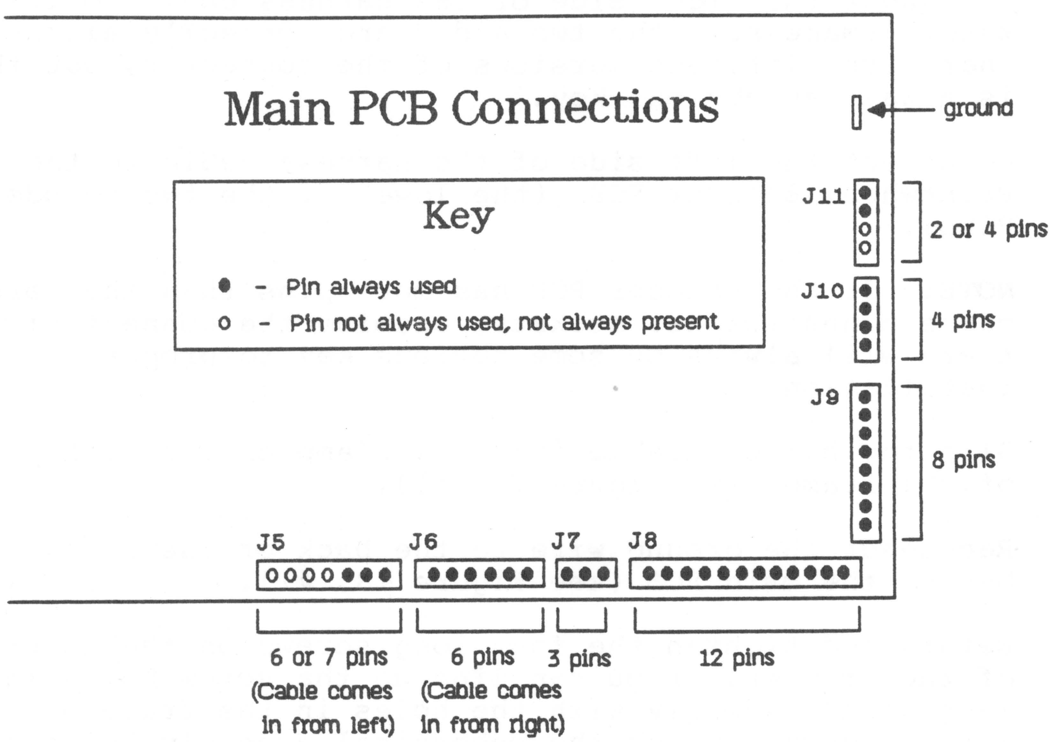


FIGURE 21

9 - REPLACE MAIN PCB:

*1. Return the main PCB to service position (use midpoint holes for the two fasteners). (See Figure 20, #1.)

*2. Reconnect the ground wire. (See Figure 20, #3.)

*3. Replace the connectors (see Figures 20 and 21).

*4. Plug in the two encoder PCBs. The connectors are keyed so that you cannot put the PCBs on the wrong jacks, but be sure the carriage motor's cable goes to the upper encoder PCB and the (printwheel motor's) harness cable to the lower encoder PCB.

If you are installing a Carriage Assembly or Carriage Motor, return to that procedure now.

*5. **CAUTION: In the following steps, AVOID STRAIN ON THE CABLES.**

Release the PCB from the work position and ease it down into its ready position. If any cable seems strained, reroute it.

*6. Fit the right, center and left parts of the bottom edge into the slot at the back of the frame, and refasten the white plastic fasteners at the top corners of the PCB. **IF YOU HAVE TROUBLE POSITIONING THE PCB,** make sure the slot is clear of debris and the cables are not obstructed by other components. You will have to push the PCB, but if you have to use too much force, something is probably obstructing the board.

*7. Reconnect the ribbon cable to jack S-3 (top center of PCB) (see Figure 20).

*8. Replace the ribbon cable from jack S-3 in the cable holders on the back of the PCB.

*9. If this is a new PCB, test it with the External Loop Back Test (see **Basics**).

*10. If you are installing a new carriage motor or carriage assembly, return to that procedure.

If the carriage goes crazy when you turn on the printer, you have probably connected the wrong cables to the encoder PCBs.

10 - ADJUST RIBBON SHIELD

The metal ribbon shield provides both horizontal and vertical reference marks for text alignment. It also holds the paper against the platen.

Depth:

*1. Remove the ribbon cartridge and printwheel (see **User's Manual**), and leave the printwheel assembly tilted away from the platen.

*2. **Push the paper thickness lever (at the left rear of the platen) back all the way.**

*3. Loosen the two depth control screws on the ribbon shield (see Figure 22, #1).

*4. Adjust the shield so that it rests against the platen. Test it by tapping with your finger where it touches the platen (tap both left and right sides). If you can hear the shield clap against the platen, it is too far away: there should be no gap.

*5. When the adjustment is correct, tighten the depth control screws.

*6. Move the paper release lever forward all the way and test again.

> If you are replacing a Carriage Assembly, return to that procedure now.

Height Adjustment:

*1. Insert paper (11 to 14 inches wide) and run the Terminal Self-Test to print out several rows of letters.

*2. Remove the ribbon cartridge and check for the following criteria:

   a) The bottoms of the letters appear on the baseline of the triangular reference holes on either side of the shield.

   b) The letter that appears in the central cleft of the shield points straight up. (For best results, turn off the printer and move the carriage until the character in the cleft is l, !, I or |.)

*3. If adjustment is necessary, tilt the hammer assembly away from the platen, loosen the up/down mounting screws (see Figure 22, #2) and adjust the shield to the criteria stated in step 2.

*4. Tighten the screws and return the ribbon cartridge.

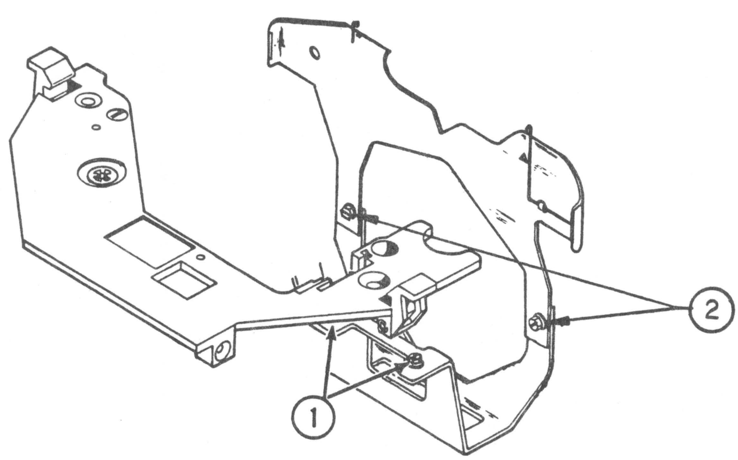


FIGURE 22

11 - FINAL CHECK

Whenever you finish any of these procedures, check that the printer is functioning properly before you return it to the customer.

*1. Defeat top cover interlock switch.

*2. Reconnect AC power cord.

*3. Switch on the power to check the Ready lamp.

*4. If installing a new main PCB, test the new board's circuitry by running the External Loop Back Test (see section 1, **Basics**).

*5. Generate a print sample with the Terminal Self-Test.

*6. Check the switch settings shown on the printout against the correct settings (shown in **Basics** or on the DWP Reference Card). If the switches are set incorrectly, reset them (see **Basics**).

*7. Check the print quality and make any necessary print quality adjustments (see **Troubleshooting** and **Print Quality Adjustments** sections).

Apple Daisy Wheel Printer
Technical Procedures

Section 4

Print Quality Adjustments

Contents:

NOTE: The Daisy Wheel Printer should be tested with the Apple II Peripherals Diskette. (See **Multi-Product Diagnostics Technical Procedures, Section 1.**)

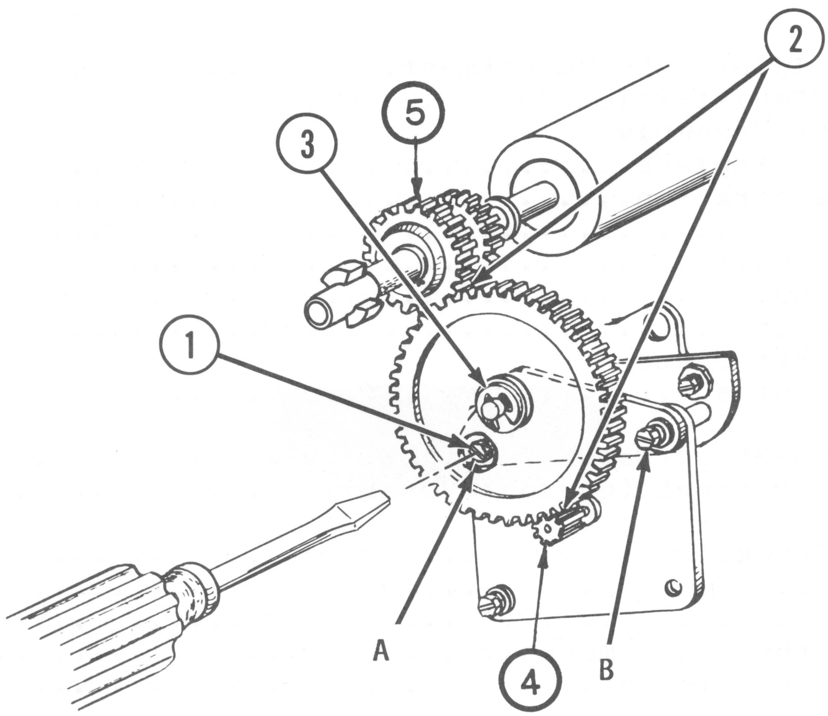


FIGURE 1

apple computer

PAPER FEED IDLER GEAR ADJUSTMENT

WHEN TO CHECK: No line feeding or irregular line feeding
(SYMPTOMS)

First character in each line drops below correct writing line

Tools and Materials Needed:

Medium flatblade screwdriver
Extra screwdriver or other sturdy object to use as a prop for the mechanical assembly

The idler gear (Figure 1, large gear) transmits the rotation of the paper feed motor gear (Figure 1, #4) to the platen drive gear (Figure 1, #5). If the three gears do not mesh properly, line feeding will be irregular and binding or backlash will occur (particularly when paper feeds both forward and reverse, as in plotting graphs).

1. Disconnect the AC power cord.

2. Remove the access cover and top cover.

3. To gain better access to the idler gear screws, loosen or remove the four screws on the bottom of the printer case, lift the front of the mechanical assembly about one inch, and prop it up on the right side with a screwdriver or other object.

4. Pull the paper bail forward (away from the platen). (The paper bail is the metal bar with three rubber rollers that holds the paper to the platen. See **Basics** for names of parts.)

5. Turn the platen knob so that screw "A" is visible through the hole in the idler gear (see Figure 1, #1).

6. Loosen the idler gear screws ("A" and "B" in Figure 1).

7. With screws A and B loose, slowly rotate the platen knob clockwise until the gears mesh easily.

   NOTE: Turning the knob clockwise actually causes the gears to mesh correctly. If you don't believe that, try turning the knob counterclockwise.

CONTINUED ON NEXT PAGE

8. While continuing to rotate the knob clockwise, tighten screw B. **CAUTION:** Do not overtighten!

9. Tighten screw A. **CAUTION:** Do not overtighten!

10. Remove the prop and lower the mechanical assembly to normal position. **CAUTION:** Be careful that the cables at the right front of the printer are not pulled or ripped by the drive-belt-adjustment screw at the right of the mechanical assembly.

11. Defeat the top cover interlock.

12. Reconnect AC power cord.

13. Run the Terminal Self-Test as a check (see **Basics**). If line feeding is regular, the idler gear is correctly adjusted.

14. If a further check is desired, run the Vertical Registration Test (below).

15. Retighten the four screws on the bottom of the printer.



Acceptable Adjustment **Poor Adjustment**

FIGURE 2

VERTICAL REGISTRATION TEST (OPTIONAL)

The following test makes any vertical registration problems easy to see. Figure 2 shows print samples generated by this test, using misadjusted and well adjusted idler gears.

To run this test, you need an Apple ///, Apple Writer ///, and familiarity with Apple Writer ///.

1. Connect the printer to an Apple ///, using an RS232 cable and a modem eliminator cable.

2. Boot Apple Writer /// in the Apple and press <RETURN> twice to obtain a blank screen.

3. Type:

   <CONTROL>p

   (That is, hold down the **<CONTROL>** key while typing **p.**)

4. A prompt line will appear at the bottom of the screen saying **[P]rint/Program :.**

   Type:

   ? <RETURN>

5. The print/program menu will now appear. Make sure that **Print Destination** is set to **.printer** and that **Carriage Return** is set to 1. If they are set to something else, type:

   pd.printer <RETURN>

   crl <RETURN>

   NOTE: Make sure you type the numeral 1, not lower-case L.

6. Type **<RETURN>** to return to the blank screen.

CONTINUED ON NEXT PAGE

7. Type **<CONTROL>v**

   A **V** should appear on the data bar at the top left of the screen. If not, try again.

8. **NOTE:** Some of the characters in this step will not appear on the screen. Don't worry about that.

   Type the following with no spaces between characters, and DO NOT PRESS <RETURN> until you are told to:

   <ESCAPE>

   <CONTROL><SHIFT>6

   <CONTROL>b

   <ESCAPE>

   .

   <CONTROL>v

   <RETURN>

9. Type the following line forty eight times to obtain a printout like Figure 2:

   _ **<RETURN>**

   (that is, an underscore followed by a carriage return).

10. Type: **<CONTROL>p**

    np

    <RETURN>

    This should send the file to the printer for printing.

11. If the file does not print, or does not look like Figure 2, make sure you have typed it correctly, starting with step 3.

NOTE: Here's what this file does. Steps 3 through 5 ensure that the Apple Writer file will be sent to the printer and that a carriage return will be followed by a linefeed. Steps 7 and 8 are a command sequence that sets the printer's linefeed to 1/48 inch. Step 9 is a print file consisting of 48 underscores, which will be printed one under the other. Step 10 sends the file to the printer. The result should look like Figure 2.

12. Compare your printout with Figure 2. If the registration is not acceptable, readjust the idler gear and run the test again.

13. When you are done, turn the printer off to restore normal line feeding. (Otherwise, it will continue to use 1/48 inch linefeeds.)



Acceptable Adjustment   Poor Adjustment

FIGURE 2

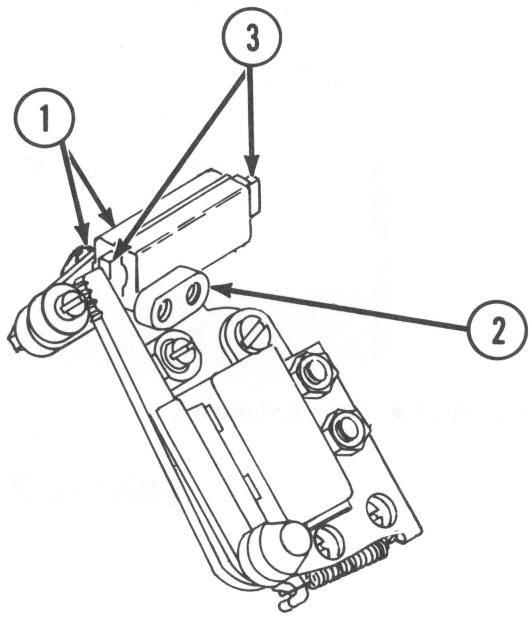


FIGURE 3

PRINT HAMMER ASSEMBLY REMOVAL/REPLACEMENT

WHEN TO REPLACE: If print quality varies irregularly
and printer has been used for at least 2 years
and other adjustments fail to correct problem

Tools and Materials Needed:

Small or medium flatblade screwdriver
3/16 inch wrench
Ruler

CAUTION: When you remove the hammer assembly (that is, the hammer and its black housing), hold the hammer in place. If you let the hammer escape from the assembly, a spring inside the hammer pops out and is easy to lose.

To Remove:

1. Disconnect the AC power cord.
2. Open the access panel.
3. Remove the ribbon cartridge and printwheel.
4. Holding the ends of the print hammer with your thumb and index finger (see Figure 3, #3), remove the two adjustment screws (Figure 3, #1) with either a flatblade screwdriver or a 3/16 inch box wrench.
5. Retrieve the nut plate (Figure 3, #2), which came loose as the screws were removed.
6. Remove the hammer assembly.

To Replace:

1. Grasping the print hammer between your thumb and index finger, hold the assembly in place and insert the two adjustment screws.
2. Release the print hammer and put the nut plate in position (flat side of plate toward hammer assembly).
3. Tighten the screws part way.

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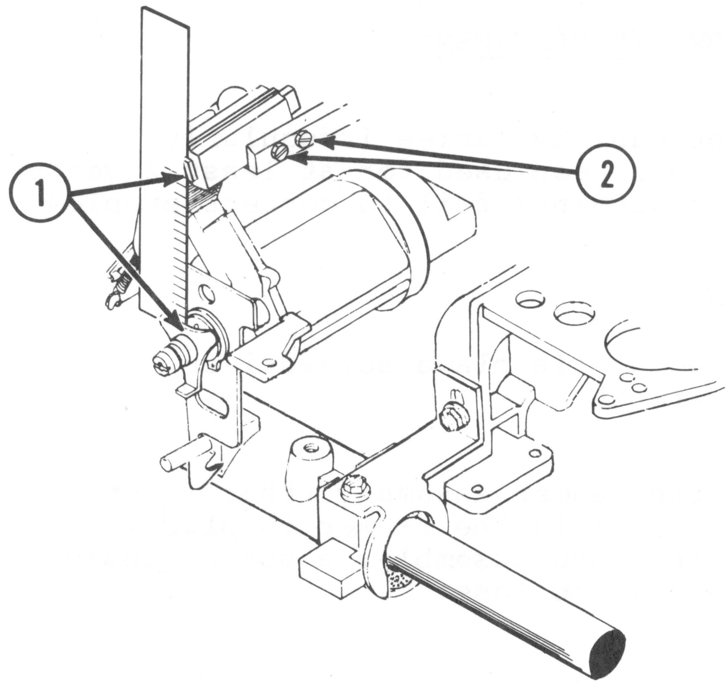


FIGURE 4

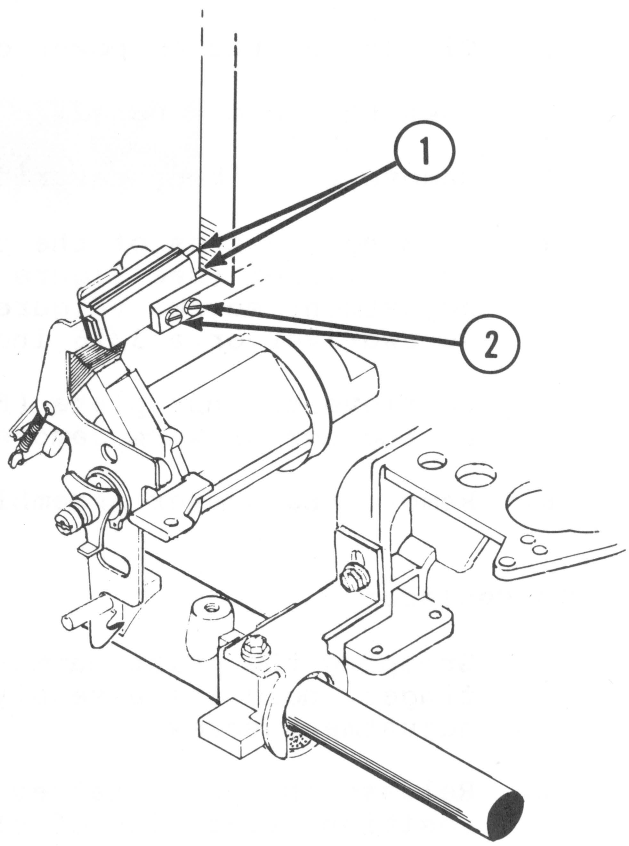


FIGURE 5

4. Measure the distance between the printwheel inner hub and the bottom of the print hammer (see Figure 4, #1: the figure shows the view from the platen side).

5. If this distance is not 1 3/4 inches, adjust it by loosening the two adjustment screws (see Figure 4, #2), moving the hammer, and retightening the screws.

   NOTE: Don't labor over exact measurement at this point. These adjustments are only rough and will be refined later.

6. Next, rest the ruler on top of the casting above the adjustment screws (on the side where you inserted the screws) and measure the distance to the top of the print hammer (see Figure 5, #1).

7. If the distance is not 1/8 inch, adjust it by loosening the two print hammer adjusting screws (see Figure 5, #2), moving the hammer, and retightening the screws.

8. If you have not already done so, retighten the adjustment screws. **DO NOT OVERTIGHTEN!**

9. Complete the hammer penetration and front and rear stop adjustments (procedures on following pages); then perform the Print Hammer Angle Adjustment.

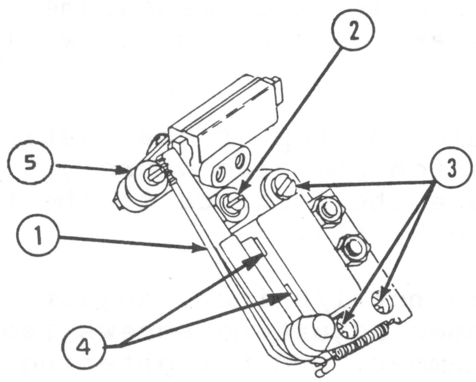


FIGURE 6

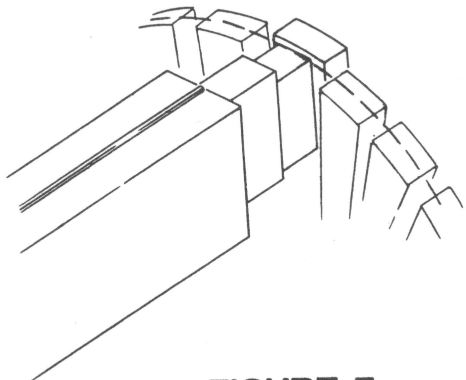


FIGURE 7

PRINT HAMMER PENETRATION AND FRONT AND REAR STOP ADJUSTMENTS

WHEN TO CHECK: Characters missing or light or too heavily inked
After installing new hammer

Tools and Materials Needed:

Apple Combination Gauge
Small flatblade screwdriver
3/16 inch wrench

The penetration adjustment is critical to print quality. If the penetration is too shallow, the print will be light; if it is too deep, it may puncture the paper and will cause excessive wear and breakage of printwheels, as well as messy printing. To adjust the penetration, you must move the front and rear stops (Figure 6, #2 and #5) out of the way. And of course, that means that you will have to adjust them as your next step.

The hammer armature front stop (Figure 6, #2) limits wear between the armature (Figure 6, #1) and the coil pole pieces (Figure 6, #4). The adjustment is more to reduce wear than to improve print quality.

The rear stop establishes the rest position of the hammer, and it, too, affects print quality. If the hammer rests too far forward, it won't gain enough speed before it hits the printwheel, and the print will be light. If it rests too far back, it may hit the printwheel too hard and cause messy, overinked printing.

To Inspect:

1. Remove the printwheel and lay it on a flat surface.

2. Inspect the printwheel to see that all spokes are in the same plane and that none are bent or warped. If damaged, replace with a new printwheel.

3. Return the printwheel to the printer and tilt the printwheel assembly toward the platen until it is locked in the print-ready position.

4. Move the armature (Figure 6, #1) against the coil pole pieces (Figure 6, #4), and check that the hammer is deflecting a printwheel spoke about half the thickness of a spoke, as shown in Figure 7. Check this measurement at several locations around the printwheel (simply spin the printwheel with your finger). If adjustment is needed, follow the procedure below.

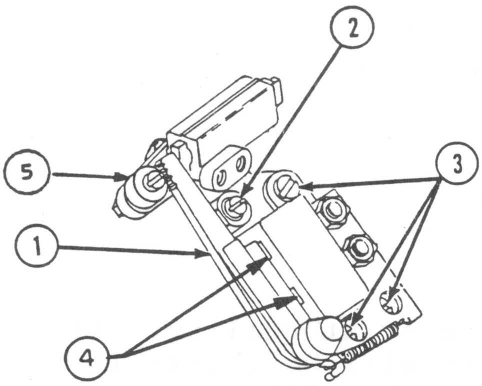


FIGURE 8

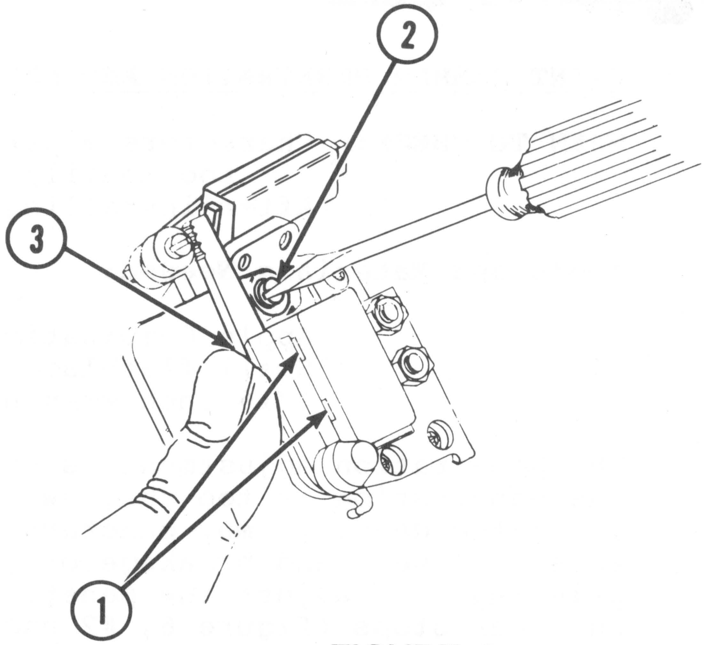


FIGURE 9

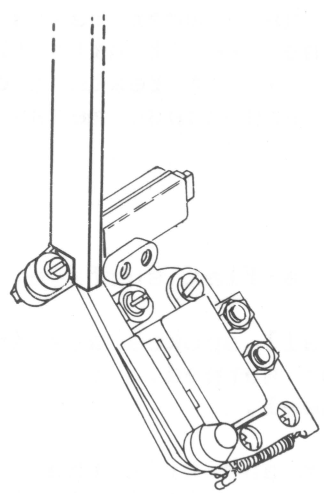


FIGURE 10

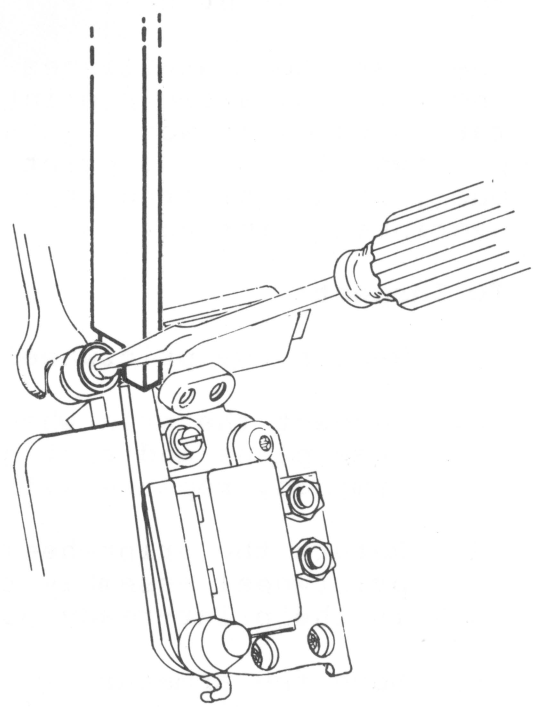


FIGURE 11

To Adjust Penetration:

1. The front stop (Figure 8, #2) is an eccentric screw held in place by a locking nut. With a 3/16 inch wrench on the nut and a flatblade screwdriver in the eccentric, loosen the eccentric.

2. Move the front stop all the way forward, to allow movement of the armature assembly.

3. With a 3/16 inch wrench and a screwdriver, loosen the lock nut on the rear stop (Figure 8, #5; see Figure 11).

4. Rotate the eccentric to move the rear stop all the way back, to allow movement of the armature assembly.

5. With a flatblade screwdriver, loosen the three armature penetration screws (see Figure 8, #3). **NOTE:** To reach the top screw, hold the print hammer's release lever out of the way.

6. Move the armature assembly forward or backward to achieve the desired penetration of half the thickness of a spoke. Tighten screws and recheck the adjustment.

7. When the adjustment appears satisfactory, adjust the front and rear stops (see next section).

To Adjust Front Stop:

1. Loosen the front stop (Figure 9, #2) with a 3/16 inch wrench on the nut and a flatblade screwdriver in the eccentric screw.

2. Push the hammer armature (Figure 9, #3) against the coil pole pieces (Figure 9, #1).

3. Using the screwdriver, rotate the front stop so that the hammer armature just touches the coil pole pieces and the front stop. Then carefully tighten the nut on the front stop. **DO NOT OVERTIGHTEN!**

To Adjust Rear Stop:

1. Push the hammer armature against the coil pole pieces and hold it there.

2. Try to insert the slot at the #3 end of the combination gauge between the rear stop and the armature (see Figure 10). If it fits loosely or not at all, go on to the next step.

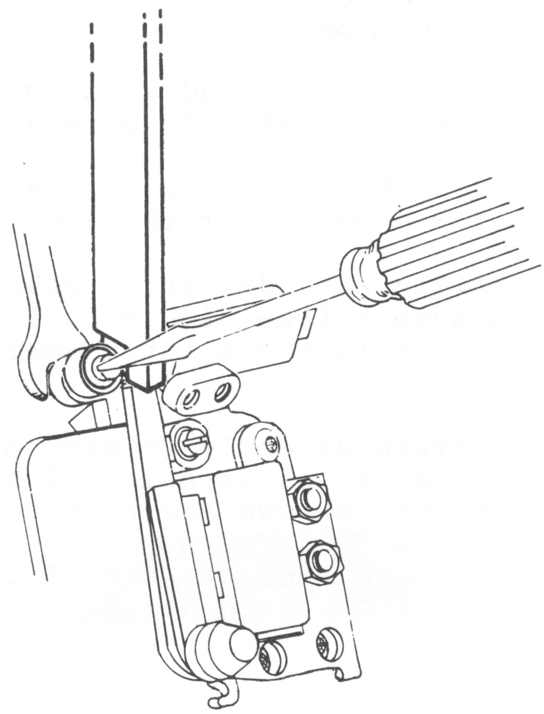


FIGURE 11

3. To adjust the rear stop, use a 3/16 inch wrench and a screwdriver to loosen the rear stop lock nut (see Figure 11).

4. Rotate the rear stop so that the gauge fits.

5. Carefully tighten the rear stop lock nut (DO NOT OVERTIGHTEN) and remove the combination gauge.

6. Perform fine tuning (below).

Hammer Adjustment Fine Tuning

1. Generate a print sample by running the Terminal Self-Test. If all characters appear too light or dark, refine the penetration adjustment. If the tops or bottoms of characters are light, perform the Print Hammer Angle Adjustment (see next page).

2. Rerun Terminal Self-Test and refine all adjustments until ink density is equal on top, bottom, and both sides of each character.

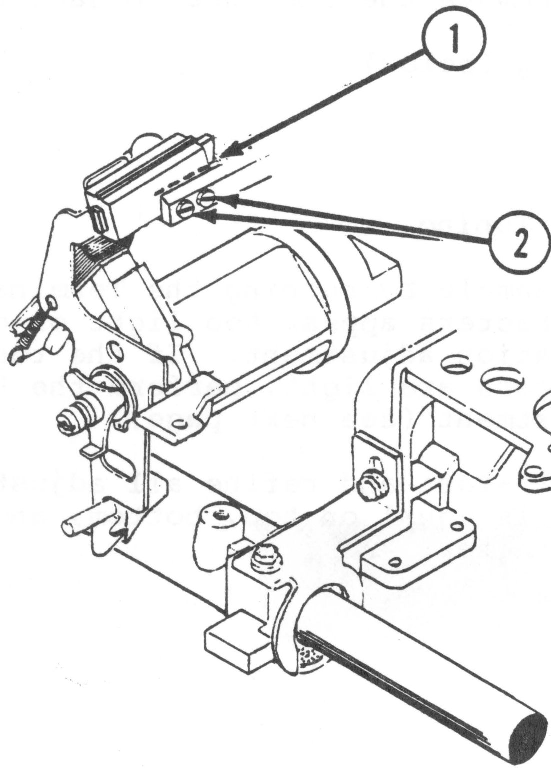


FIGURE 12

PRINT HAMMER ANGLE ADJUSTMENT

WHEN TO ADJUST: Tops of letters missing (raise rear of hammer)
Bottoms of letters missing (lower rear of hammer)

Tools and Materials Needed:

Small flatblade screwdriver
3/16 inch wrench
Pencil

NOTE: For best results, use a Proportional Space printwheel for testing this adjustment: the greater size of the characters creates a "worst case" condition which makes any misadjustment easy to see.

1. Generate a print sample by running a Terminal Self-Test (see **Basics**). If the tops or bottoms of letters are missing or light, continue this procedure.

2. Draw a reference line on the hammer housing so that you can see your adjustments (see Figure 12, #1).

3. Remove the ribbon cartridge.

4. Loosen the adjustment screws (Figure 12, #2).

5. If the tops of letters are missing, raise the rear of the print hammer; if the bottoms of letters are missing, lower the rear.

6. Tighten the adjustment screws.

7. Replace the ribbon cartridge and run another Terminal Self-Test to check adjustment.

8. Repeat steps 3-7 until print quality is optimum.

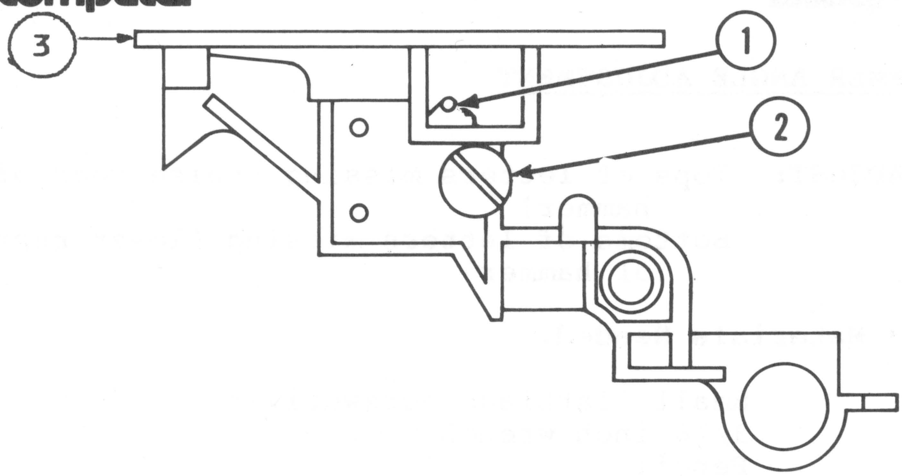


FIGURE 13

RIGHT SIDE VIEW OF CARRIAGE ASSEMBLY

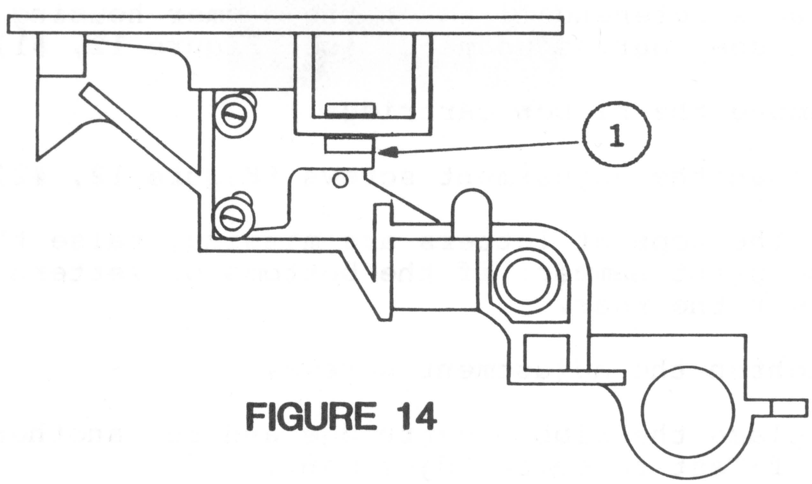


FIGURE 14

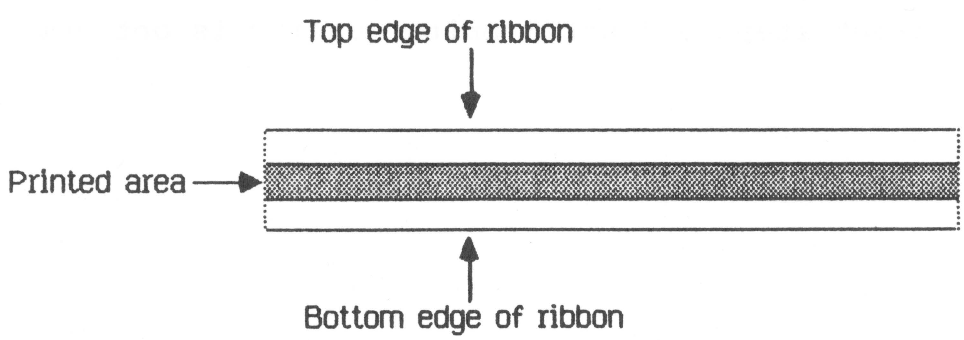


FIGURE 15

RIBBON SUPPORT PLATE ADJUSTMENT

WHEN TO ADJUST: (SYMPTOMS) Tops or bottoms of characters not printing **and** type too high or low on ribbon (see explanation below)

Tools and Materials Needed:

1/4 inch wrench
Medium flatblade screwdriver

If some letters are getting insufficient inking at top or bottom, check the ribbon first. The printwheel may be hitting too high or too low on the ribbon, and you can tell that by simple inspection: the printwheel should be hitting the middle of the ribbon (see Figure 15). If the printwheel is hitting too close to the top or bottom edge of the ribbon, the tops or bottoms of characters will be lost.

To correct this, you can adjust the ribbon position -- by adjusting the ribbon support plate (Figure 13, #3), which the ribbon rests on. This is the only situation in which you would adjust the ribbon support plate.

There are two arrangements of the ribbon support plate. Older models have a metal **eccentric** (Figure 13, #2) and **up-stop** (Figure 13, #1), which adjust and stabilize the height of the plate. Newer models use a **plastic bracket** (Apple P/N 970-0626; Figure 14, #1), which should be retrofitted onto older models if the metal up-stop breaks. Adjustment procedures for the up-stop and eccentric are given first; those for the plastic bracket, second.

TO CHECK ADJUSTMENT

NOTE: For best results, use a Proportional Space printwheel for testing this adjustment: the greater size of the characters creates a "worst case" condition which makes any misadjustment easy to see.

1. Obtain a print sample by performing a Terminal Self-Test, printing at least one full line of the complete character set.

2. Remove the ribbon cartridge and look at the used section of ribbon. The printwheel should be hitting exactly in the middle of the ribbon (see Figure 15). If the printwheel is hitting higher or lower than that, adjust the ribbon support plate.

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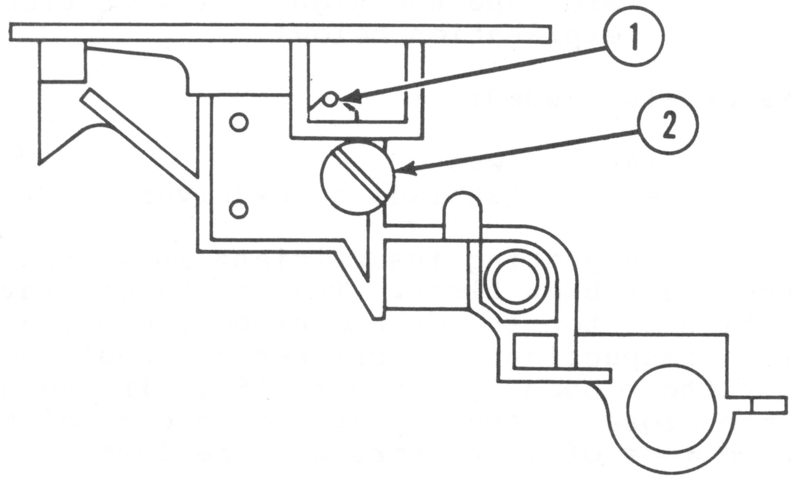


FIGURE 16

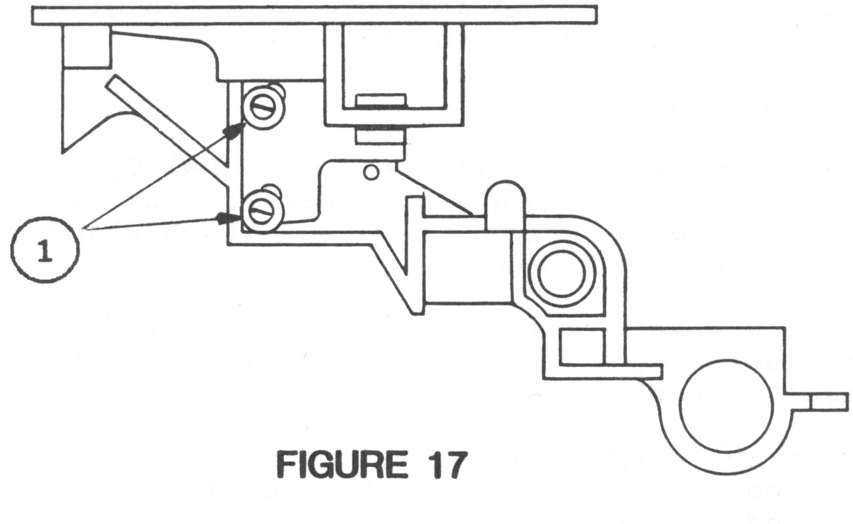


FIGURE 17

TO ADJUST

For Models with Metal Up-Stop

CAUTION: The up-stop breaks off easily if its nut is overtightened.

1. Disconnect the AC power cord.

2. Remove the ribbon cartridge.

3. Loosen the nut on the back of the up-stop with a 1/4 inch wrench. Rotate the up-stop to its highest position. (See Figure 16, #1.)

4. Use a flatblade screwdriver in the eccentric (Figure 16, #2) to raise or lower the support plate. **If the print is too high on the ribbon**, the ribbon is too low, so raise the support plate.

   If print is too low on ribbon, ribbon is too high, so lower the support plate.

5. When the support plate is properly adjusted, lower the up-stop so that it touches the support plate, and carefully tighten the nut. (**DO NOT OVERTIGHTEN.**)

6. Check the adjustment (see "TO CHECK ADJUSTMENT," above); readjust the support plate as necessary.

For Models with Plastic Bracket

1. Disconnect the AC power cord.

2. Remove the ribbon cartridge.

3. Loosen but do not remove the two bracket adjustment screws (Figure 17, #1).

4. **If the print is too high on the ribbon**, raise the support plate by pulling the plate upwards and then tightening the bracket screws.

   If print is too low on ribbon, lower the support plate by pushing down on it and then tightening the bracket screws.

5. Check the adjustment (see "TO CHECK ADJUSTMENT," above); readjust the support plate as necessary.

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PLATEN HEIGHT AND DEPTH ADJUSTMENT

WHEN TO CHECK: (SYMPTOMS) Tops or bottoms of characters not printing; ribbon support plate and hammer adjustments do not solve problem

Print quality lighter at one side of page

Tools and Materials Needed:

- Torx screwdriver (see Tools section of Basics)
- Apple Combination Gauge
- 5/8 inch open-end wrench or duckbill pliers or needlenose pliers
- Medium flatblade screwdriver

You will almost never need to adjust the platen. It is fitted with tamper-proof Torx screws to discourage users from changing the adjustments, and in normal use the adjustments are not likely to shift.

However, if the tops or bottoms of letters are not printing, and the print hammer or ribbon support plate adjustments do not remedy the problem, check the platen height. If the platen is too high, the bottoms of letters will not print; if it is too low, the tops will be missing. (See Table 1 for print samples.)

If the print quality varies from the left side to the right side of the printed line, uneven platen depth almost certainly is the cause.

If you do not have the special Torx screwdriver that fits the platen adjustment screws, you will have to loosen and tighten the screws with pliers.

NOTE: Do not adjust the platen unless you are sure that it is necessary: once you change the platen adjustment, you increase the chances that it will need to be adjusted in the future.

A. HEIGHT

1. Disconnect the AC power cord.

2. Remove the top cover.

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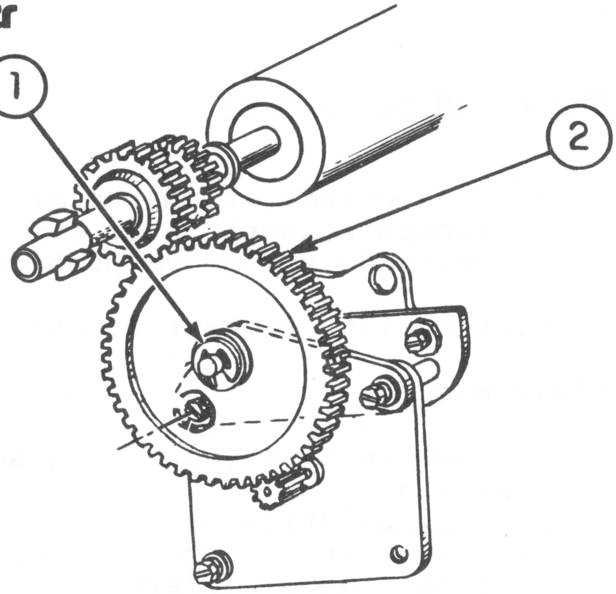
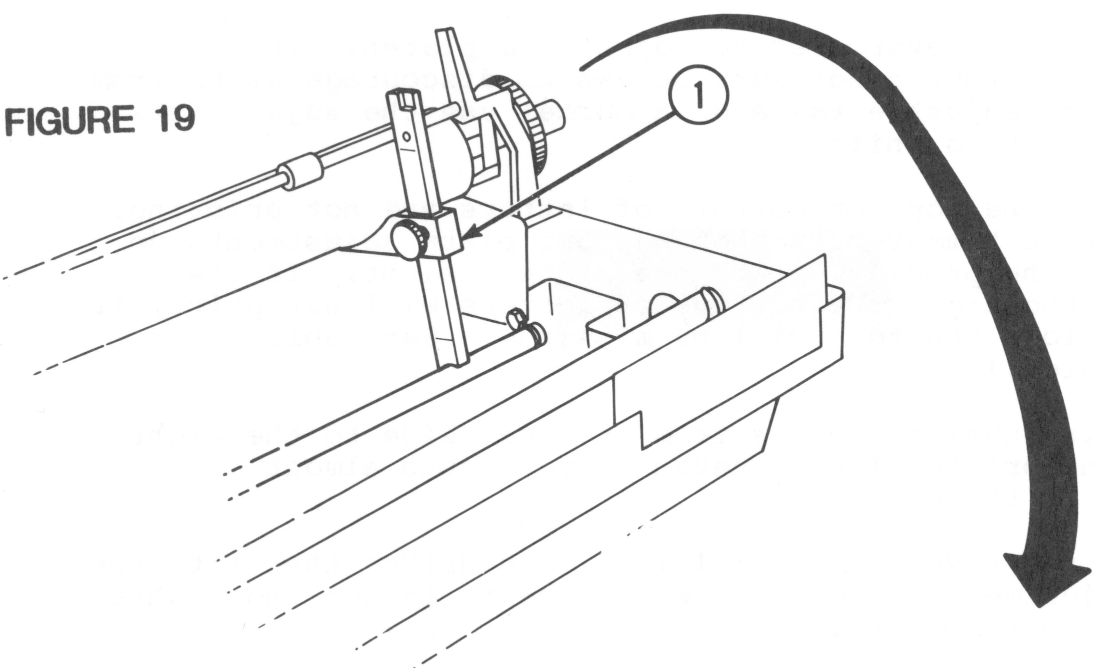


FIGURE 18

FIGURE 19



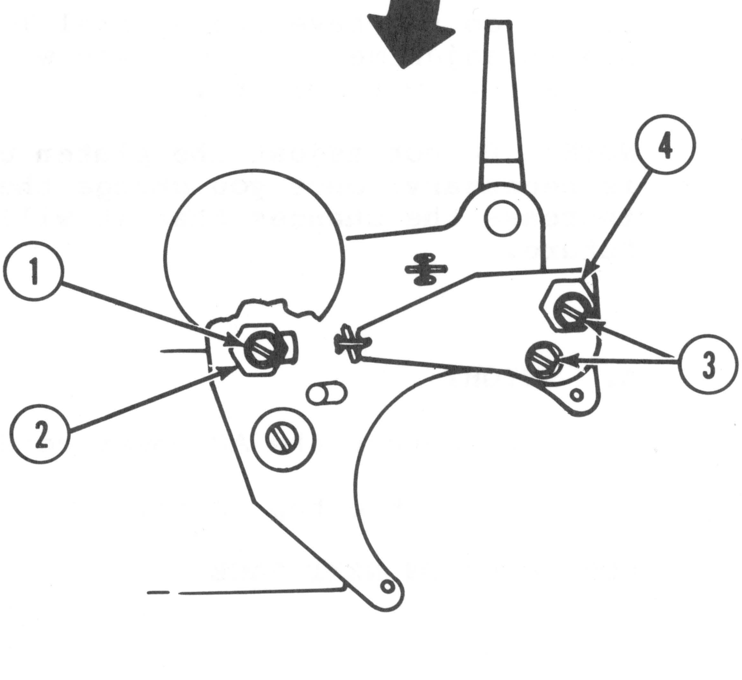


FIGURE 20

3. Remove the idler gear (Figure 18, #2) by removing the E-clip (Figure 18, #1) and pulling the gear off.

4. Move the paper thickness lever (left side, behind platen) to full forward position.

5. Move the carriage assembly to the center of the printer.

6. Set the combination gauge slide to the #2 position and place it between the rear guide shaft and the platen, near the right side of the platen. (See Figure 19, #1.)

7. If there is a space between the gauge slide and the platen, or if the gauge slide does not fit under the platen, the platen is misadjusted and you should continue with step 8. Otherwise, skip to step 10.

8. Loosen the lock screw (Figure 20, #1) just enough to allow rotation of the 5/8 inch eccentric nut (Figure 20, #2). (Rotating the eccentric changes the height of the platen.)

9. Now rotate the eccentric (with 5/8 inch wrench or pliers) until the surface of the platen just touches the combination gauge slide. Then tighten the lock screw.

10. Repeat steps 6-9 for the left side of the platen. (See Figure 21, #1.)

11. Check the adjustments (see below, Section C): Adjusting the platen height may cause changes in the platen depth adjustment. Be sure to check that too. (See next page.)

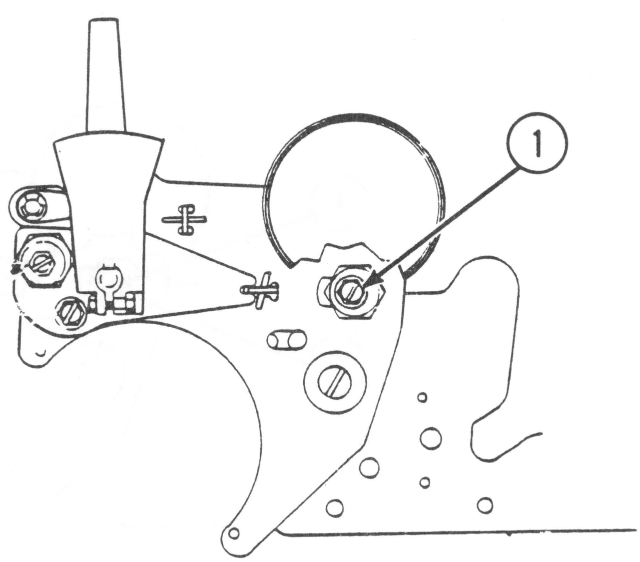


FIGURE 21

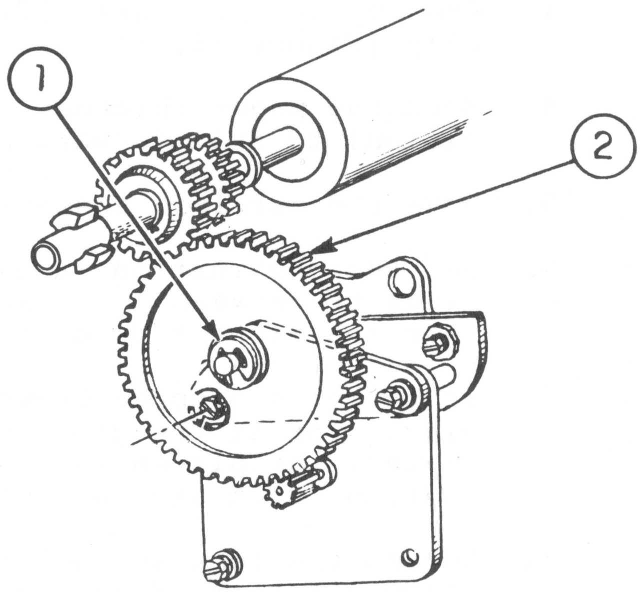


FIGURE 22

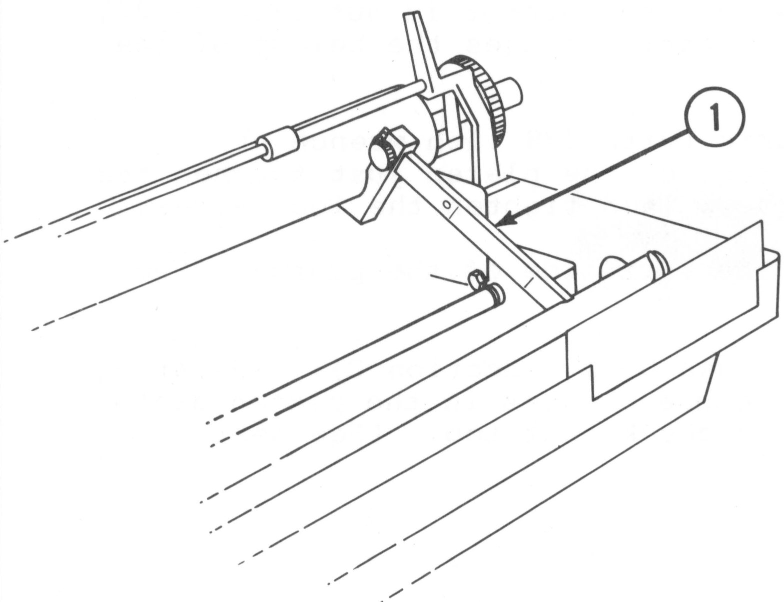


FIGURE 23

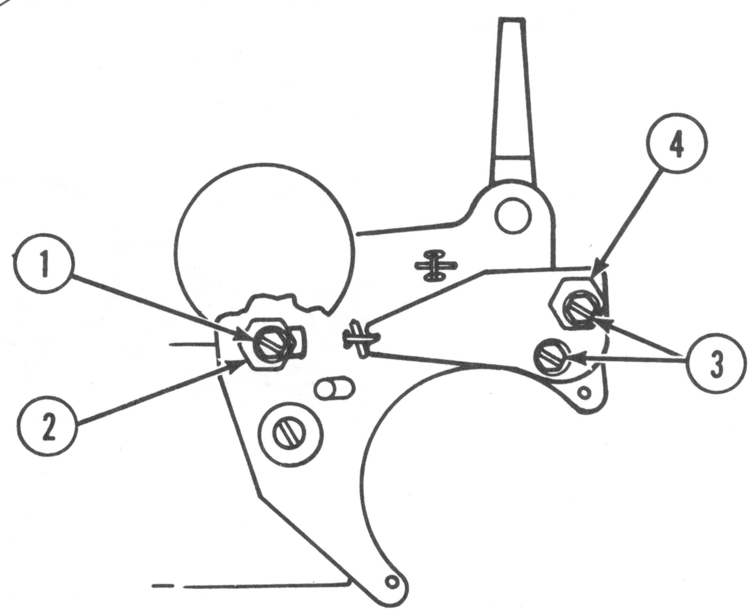


FIGURE 24

B. DEPTH

1. Disconnect the AC power cord.

2. Remove the top cover.

3. Remove the idler gear (Figure 22, #2) by removing the E-clip (Figure 22, #1) and pulling the gear off.

4. Move the paper thickness lever (left side, behind platen) to full forward position.

5. Move the carriage assembly to the center of the printer.

6. Set the combination gauge to the #3 position and insert it on the right side of the printer between the front shaft and the platen. (See Figure 23.)

7. If the gauge fits too loosely or not at all, loosen the **two** lock screws (Figure 24, #3) just enough to allow rotation of the rear 5/8 inch eccentric nut (Figure 24, #4.) IMPORTANT: YOU MUST LOOSEN BOTH SCREWS. OTHERWISE YOU MAY SHEAR OFF THE BOTTOM SCREW WHEN YOU TRY TO ADJUST THE ECCENTRIC.

8. Rotate the eccentric (with 5/8 inch wrench or duck-bill pliers) until the platen's front surface just touches the combination gauge slide. Then tighten both lock screws.

9. Remove the combination gauge and replace it on the left side.

10. Repeat steps 6 - 8 for the left side of the printer.

11. Check the adjustments (see below): Adjusting the platen depth may cause changes in the platen height adjustment.

C. CHECKING THE ADJUSTMENTS

NOTE: For best results, use a Proportional Space printwheel for testing these adjustments: the greater size of the characters creates a "worst case" condition which makes any platen height misadjustment easy to see.

1. Recheck the platen height and depth adjustments with the combination gauge. Make additional adjustments as necessary.

CONTINUED ON NEXT PAGE

2. Replace the idler gear and E-clip, the printwheel, and the ribbon cartridge.

3. Reconnect the AC power cord and defeat the top cover interlock.

4. Turn the printer on and perform the Terminal Self-Test, printing at least three lines of the complete character set.

5. Readjust the platen height and depth as necessary until printing is satisfactory.

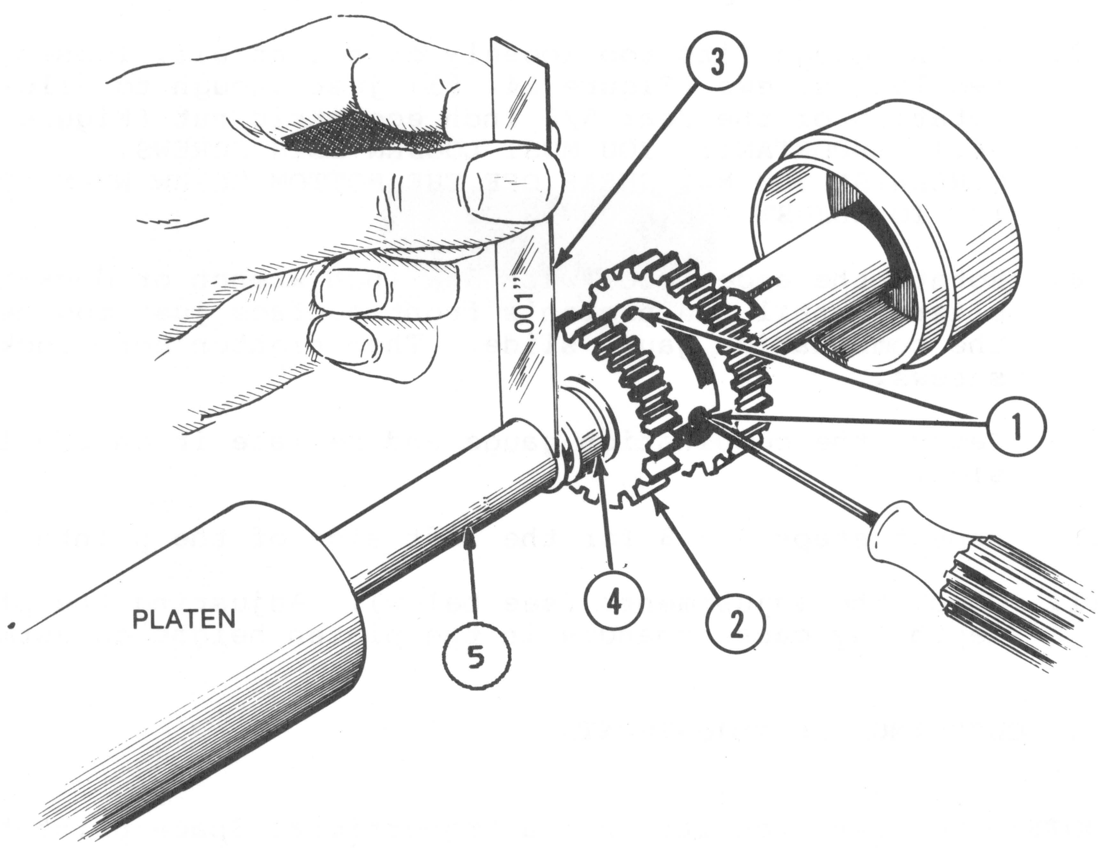


FIGURE 25

PLATEN LOCATOR SLEEVE ADJUSTMENT

WHEN TO ADJUST: Horizontal registration irregular; in boldface or shadow printing, uneven character width or two letters visible instead of one bold letter

Tools and Materials Needed

.072 inch six-flute spline wrench
.001 - .003 inch feeler gauges

The platen is the long black rubber roller that supports the paper. The platen locator sleeve (Figure 25, #4) is on the right side of the platen, near the tractor gear (Figure 25, #2). There should always be a small amount of end play (.001 to .003 inches) between the locator sleeve and the tractor gear: if there is too little play, the sleeve will bind and interfere with line feeding. On the other hand, if there is too much play, the platen may shift from side to side, so that the horizontal position of each print column will shift from line to line.

NOTE: You can measure the end play between the locator sleeve and the tractor gear, or between the bearing sleeve (Figure 25, #5) and the locator sleeve, as shown in Figure 25: the result will be the same.

To Check Adjustment:

1. Remove the top cover.

2. Pull the paper bail forward (away from the platen).

3. Remove the platen by placing one hand on each end, pushing down on the platen release levers (one on each side) with your thumbs, and lifting the platen free.

4. Hold the platen vertical, so that the tractor gear (Figure 25, #2) is at the top.

5. With your fingers, twirl the bearing sleeve (Figure 25, #5) in one direction and the platen locator sleeve (Figure 25, #4) in the other direction. At some point they will probably bind (resist movement). Move them in the opposite direction until you find the point at which they are loosest. (If you cannot move them at all, they are too tight and should be adjusted.)

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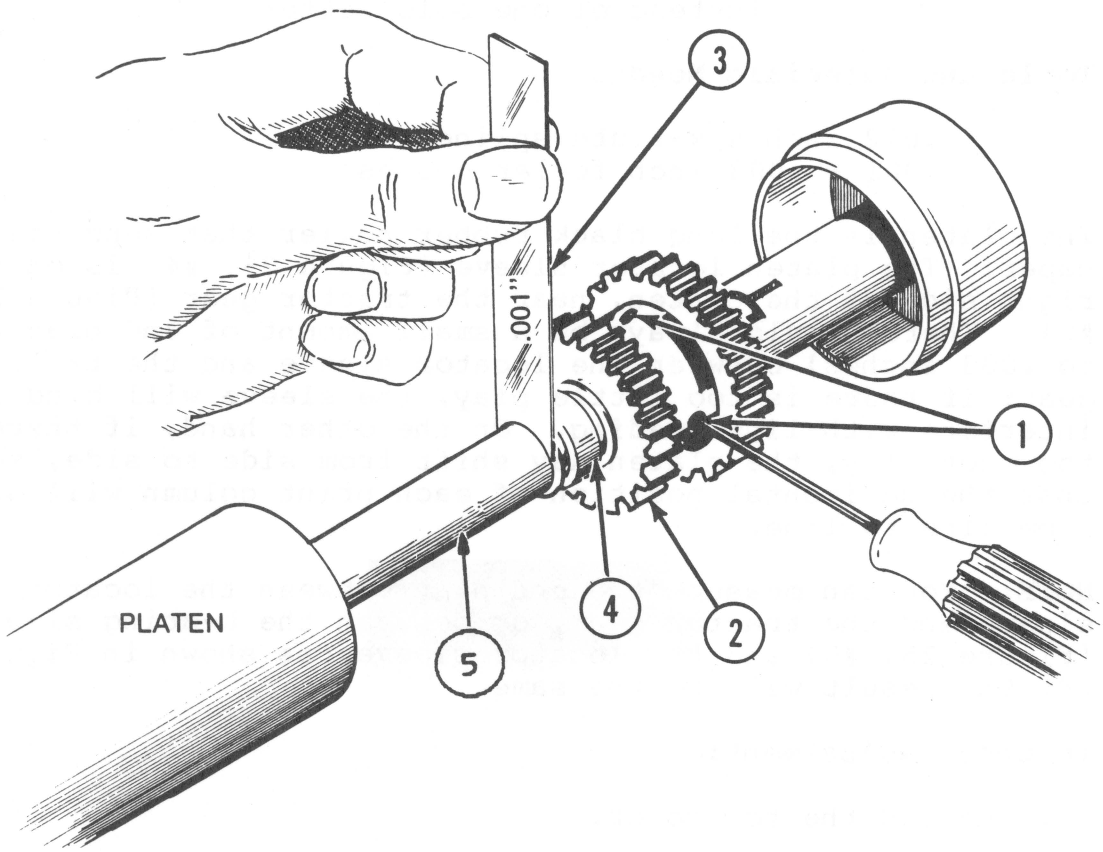


FIGURE 25

6. At the loose point of the two sleeves, try to insert a .004 inch feeler gauge. If you **can** insert it, the sleeves are too loose and should be adjusted. If you **cannot** insert the .004 inch gauge, try to insert a .001 inch gauge. If you can insert it, the sleeves are well adjusted. If you cannot insert it, the sleeves are too tight and should be adjusted.

To Adjust:

1. Hold the platen upright so that the tractor gear (Figure 25, #2) is at the top.

2. Find the point at which the two sleeves are loosest. If you can, insert a .001 or .0015 inch feeler gauge between the sleeves (see Figure 25). (If you can't, go on to step 3).

3. Loosen the two collar set screws (Figure 25, #1) with the .072 inch six-flute spline wrench. (Insert the .001 or .0015 inch feeler gauge between the sleeves at the loosest point between them, if you have not already done so.)

4. Let gravity push the tractor gear against the feeler gauge; then tighten the set screws.

5. Remove the feeler gauge and try to twirl the bearing sleeve (Figure 25, #5). A small amount of binding is acceptable, but you should be able to overcome it with a little pressure from your fingers. If the sleeve binds strongly, loosen the collar set screws and repeat the adjustment using a .002 inch feeler gauge.

6. When the .001 or .0015 feeler gauge fits and the bearing sleeve does not bind badly when twirled, test the gap with a .004 inch gauge. If the larger gauge fits, the gap is too large. If you cannot readjust the sleeves to within tolerance (.001 to .003 inch gap), replace the platen or the bearing sleeve.

7. Return the platen and platen knob.

8. Defeat the top cover interlock switch.

9. Load paper and run the Terminal Self-Test as a check. Make sure the spacing between lines is even: if not, loosen the sleeve. Also run the Horizontal Registration Test (see **Take-Apart** Section).

Apple Daisy Wheel Printer
Technical Procedures

Section 5

Preventive Maintenance

Contents:

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A. INTRODUCTION

Properly maintained, the Apple Daisy Wheel printer will give excellent service for many years. The following table summarizes the manufacturer's preventive maintenance requirements.

Operator or field service duties — perform as required:

1. Clean ribbon shield
2. Clean printwheel
3. Clean covers
4. Clean platen, feed rollers, paper bail rollers

Field Service — perform as required:

1. Replace felt wipers
2. Lubricate feed roller shafts
3. Check print quality (see section 1 above, p. 1.5)

Field Service — once a year or every 2000 operating hours

1. Clean and lubricate carriage drive shafts
2. Lubricate felt pad on paper feed idler gear stud
3. Lubricate carriage felt wipers

Field Service — once every two years or 4000 operating hours

1. Lubricate platen sleeve

Field Service — required only in very harsh environments

1. Clean print hammer
2. Lubricate drive belt pulley

NOTES:

1. These procedures are designed for normal environments. Printers in exceptionally harsh operating environments may require different or more frequent preventive maintenance (see section E).

2. Use only the recommended types of cleaners, lubricants, etc.

3. Clean plastic parts only with a low residue cleaner such as rubbing alcohol; do not use high residue cleaners such as soaps; **NEVER** use solvent based cleaners (such as those containing toluene), as they will destroy the plastic.

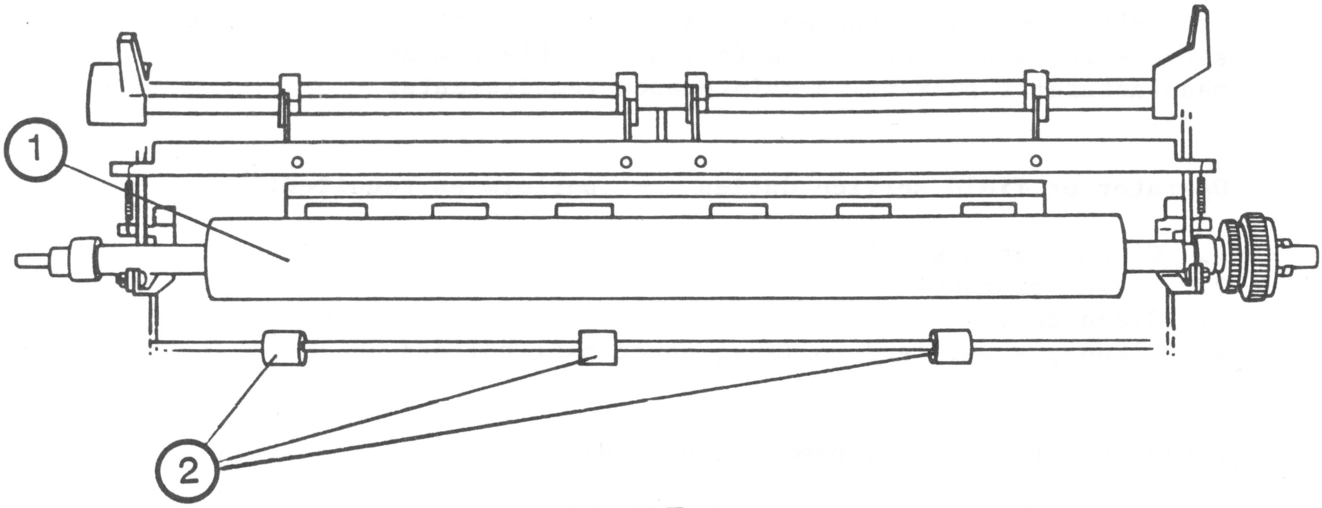


FIGURE 1

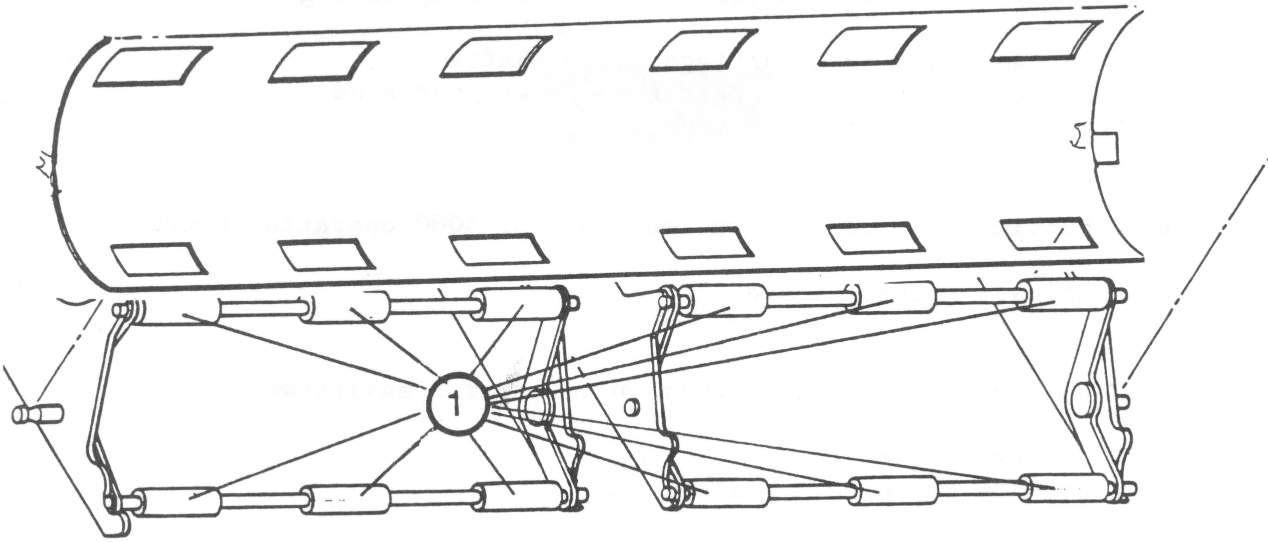


FIGURE 2

B. CLEANING

Printwheel:

1. Remove printwheel.

2. Soak printwheel in low residue cleaner such as alcohol.

3. Use medium stiff brush to clean (gently).

4. Thoroughly rinse and dry.

5. Reinstall when dry.

   NOTE: DWP's that use a fabric-based ribbon may require more frequent printwheel cleaning.

Platen, Feed Rollers, Paper Bail Rollers (Rubber Parts):

1. Remove top cover, ribbon cartridge and printwheel.

2. Remove platen.

3. Lift platen cradle out of the way (see Figure 2).

4. Moisten a soft cloth with Fedron platen cleaner and clean platen (Figure 1, #1), paper bail rollers (Figure 1, #2), and feed rollers (Figure 2, #1).

   CAUTION: FEDRON SHOULD BE USED ONLY IN A WELL VENTILATED AREA. DO NOT USE FEDRON ON PLASTIC PARTS.

   NOTE: It is important to use an approved platen cleaner, such as Fedron brand. The platen must offer a specific resiliency to the print hammer. Platen cleaner restores resiliency; other solvents will harden the platen and cause impaired printer performance.

Ribbon Shield and Metal Parts:

1. Remove top cover, ribbon cartridge, printwheel and platen.

2. Clean the ribbon shield and other metal parts with a soft rag and a safe degreasing agent (such as isopropyl alcohol or Freon).

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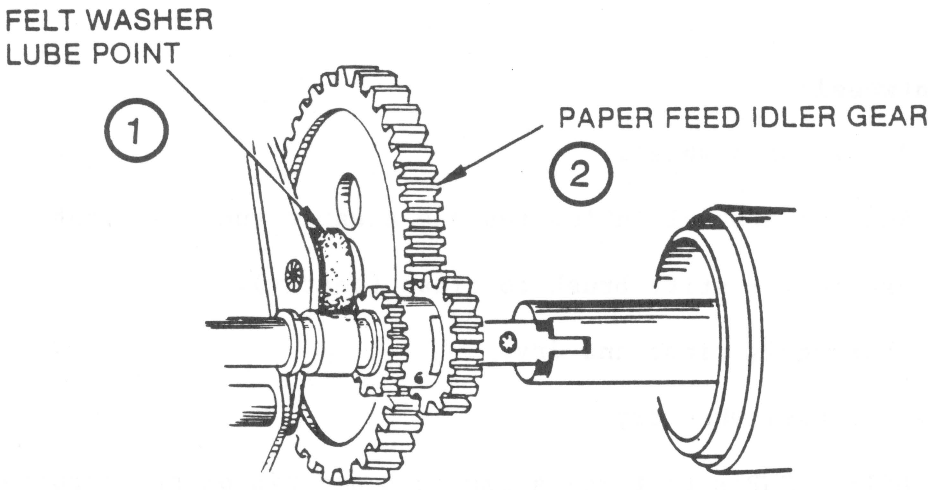


FIGURE 3

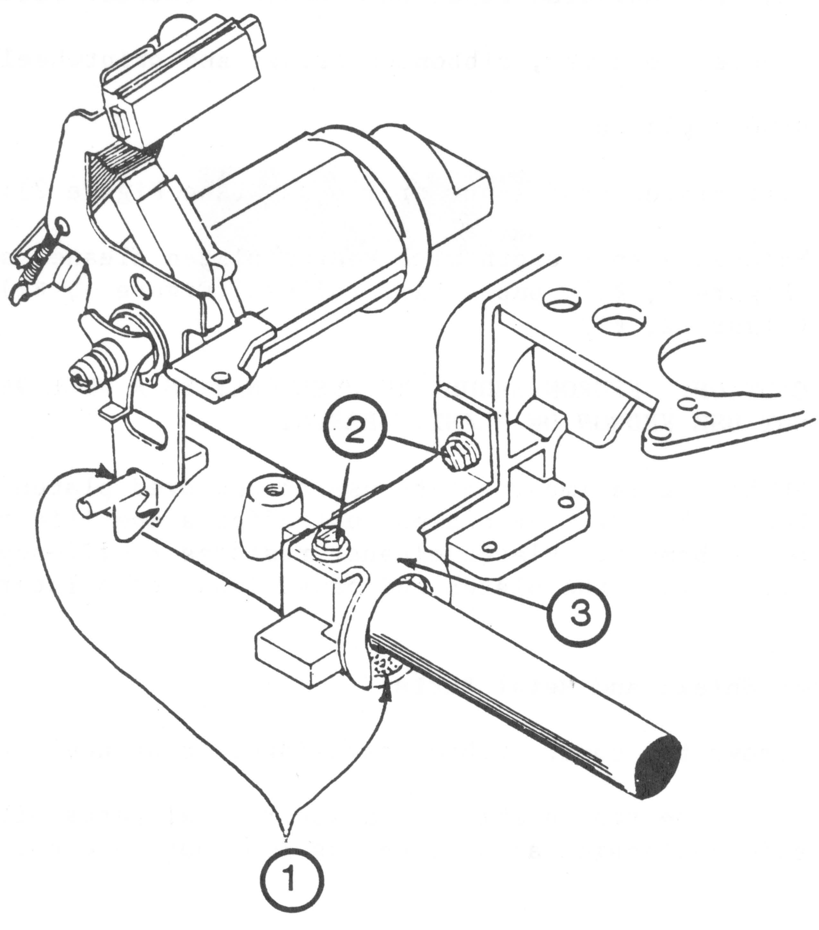


FIGURE 4

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C. LUBRICATION - ONE YEAR CYCLE

Once every year or every 2000 hours, perform the following lubrications:

1. **Felt Pad on Paper Feed Idler Gear Stud:**

   Once a year, or every 2000 operating hours, lubricate the felt washer behind the paper feed idler gear (see Figure 3, #1) with ten drops of Tellus #46 oil. Wipe off any excess oil. Do not lubricate the idler gear itself (Figure 3, #2).

2. **Carriage Drive Shaft and Felt Wipers:**

   There are two felt wipers on the rear carriage guide shaft (see Figure 4, #1). Once a year, or every 2000 hours:

   a) Wipe the carriage drive shaft clean with a soft cloth moistened with isopropyl alcohol or freon.

   b) Use a 3/16 inch wrench and/or a small screwdriver to remove the two screws (Figure 4, #2) on the retaining clamp (Figure 4, #3) on each side of the carriage assembly (Figure 4 shows only one side). Inspect the felt wiper. If very worn or dirty, remove and replace it. Otherwise, go on to step c.

   c) Lubricate both left and right wipers with Tellus #46 oil. If wipers are new, use 10 drops on each; if not new, use 5 drops each.

   d) Slide the carriage assembly back and forth to lubricate the shaft.

   e) Wipe off excess oil with a clean dry cloth and repeat step d).

3. **Clean and lubricate the front carriage guide shaft:**

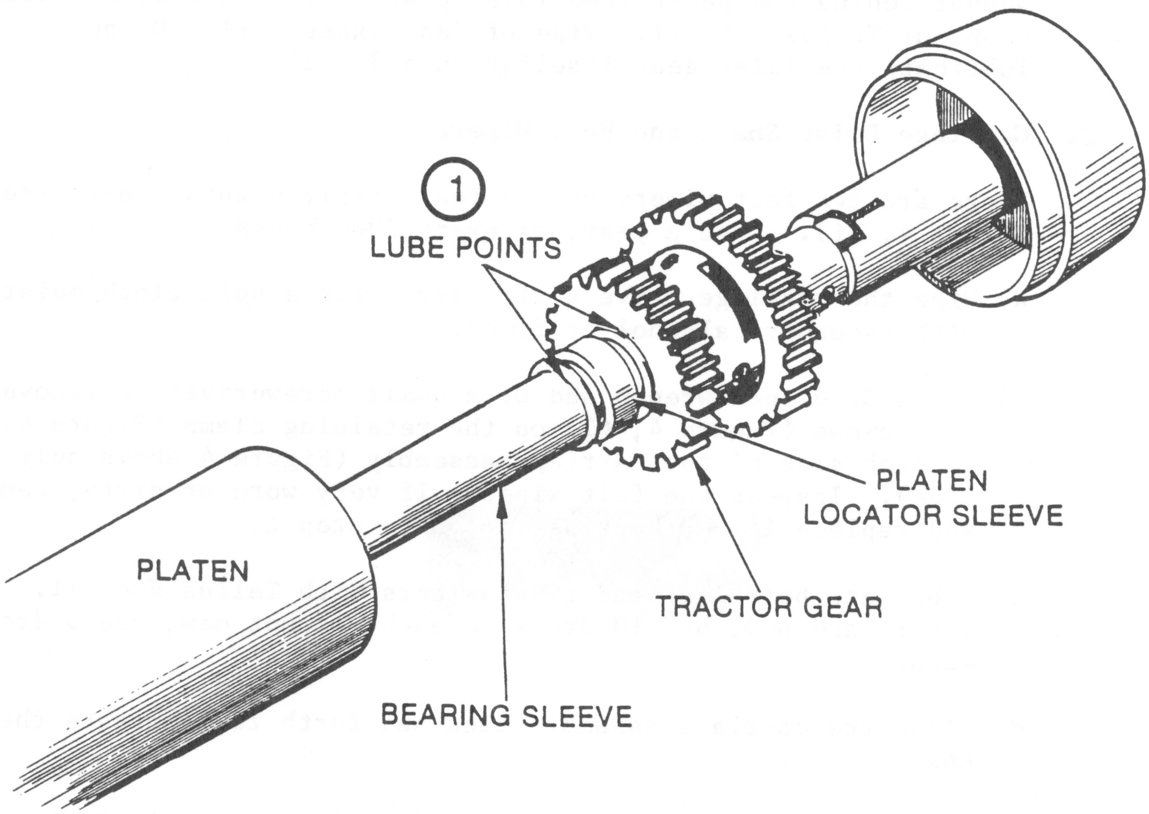
   Once a year, or every 2000 operating hours:

   a) Clean the front guide guide shaft with a soft cloth moistened with isopropyl alcohol or freon.

   b) Apply 3 drops of Tellus #46 oil with a cotton swab.

   c) Slide the carriage back and forth to lubricate the shaft.

   d) Wipe off excess oil with a clean dry cloth and repeat step c).



1
LUBE POINTS
PLATEN
LOCATOR SLEEVE
PLATEN
TRACTOR GEAR
BEARING SLEEVE

FIGURE 5

D. LUBRICATION - TWO YEAR CYCLE

Once every two years, perform the following lubrication:

Platen Sleeve Bearings:

1. Remove top cover and platen.

2. Place two drops of Tellus #46 oil at one end of the platen sleeve (see Figure 5, #1), and hold the platen vertical so that the oil flows down the shaft.

3. Twirl the sleeve to distribute the oil evenly; then wipe off excess oil. Avoid getting oil on the platen surface.

4. Repeat steps 2 and 3 for the other end of the platen.

5. Replace platen and top cover.

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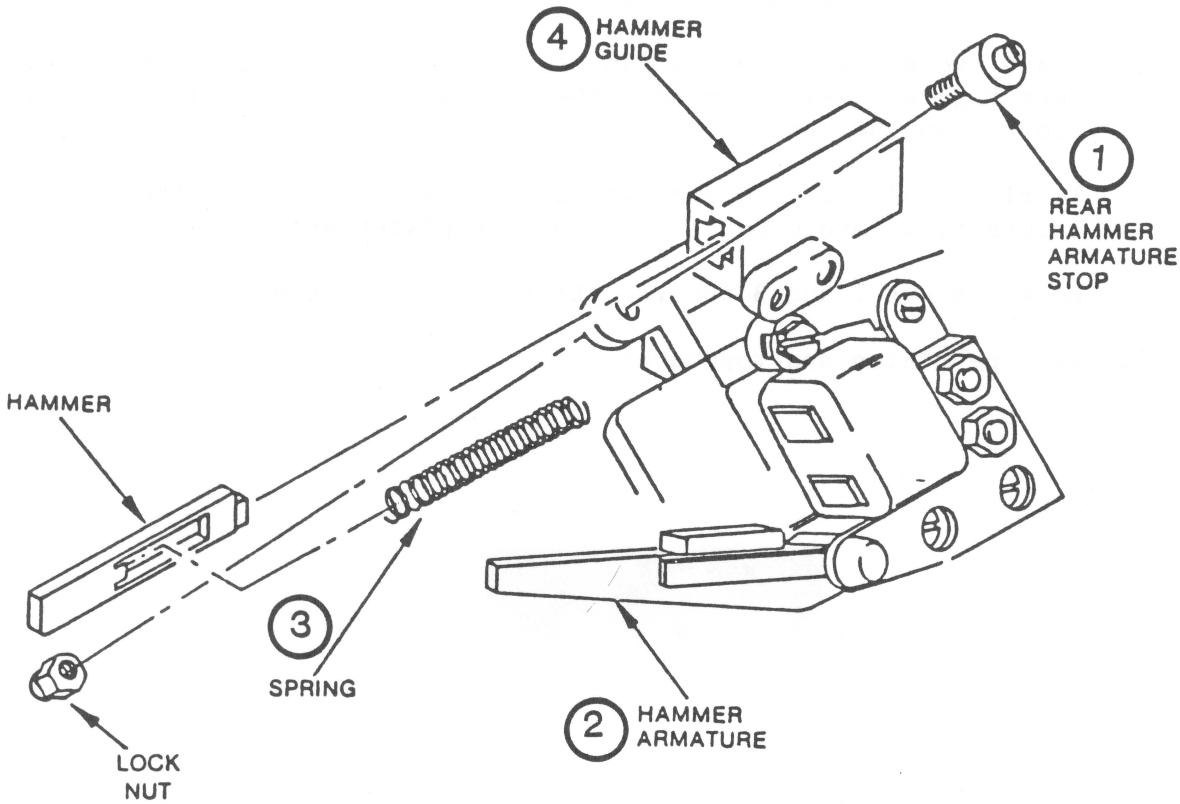


FIGURE 6

E. SPECIAL MAINTENANCE FOR HARSH ENVIRONMENTS

Where printers are subjected to airborne dirt and corrosive substances, the print hammer may need occasional cleaning and lubrication. This is not necessary under normal operating conditions.

1. Disconnect AC power cord. Remove the access cover and ribbon cartridge. Unplug the connector on the hammer coil.

2. Remove the rear hammer armature stop (Figure 6, #1) and allow the armature to pivot toward the front of the printer (toward the operator) (see Figure 6, #2).

3. Being careful to hold on to the hammer spring (Figure 6, #3) so it will not be lost, remove the print hammer from the hammer guide (Figure 6, #4) by sliding it out toward the front of the printer. Remove and retain the spring.

4. Clean both the hammer and the inside of the hammer guide with isopropyl alcohol or Freon solvent. Use a cotton swab moistened with solvent to clean inside the hammer guide. DO NOT USE SPRAY SOLVENTS.

5. Carefully replace the spring inside the hammer and install the hammer in the hammer guide. (Note that the face of the hammer is wedge-shaped. Install the hammer with the wide end of the wedge up.)

6. Pivot the hammer armature against the print hammer coil and reinstall the rear stop and locknut. Reconnect the hammer coil connector.

7. Adjust the rear hammer armature stop (see Adjustments job aids, p. 3.17).

8. Replace the ribbon cartridge and the access cover.

9. Perform terminal self-test to check print quality and make any necessary hammer adjustments.

Apple Daisy Wheel Printer
Technical Procedures

Section 6

Forms Tractor
Technical Procedures

Contents:

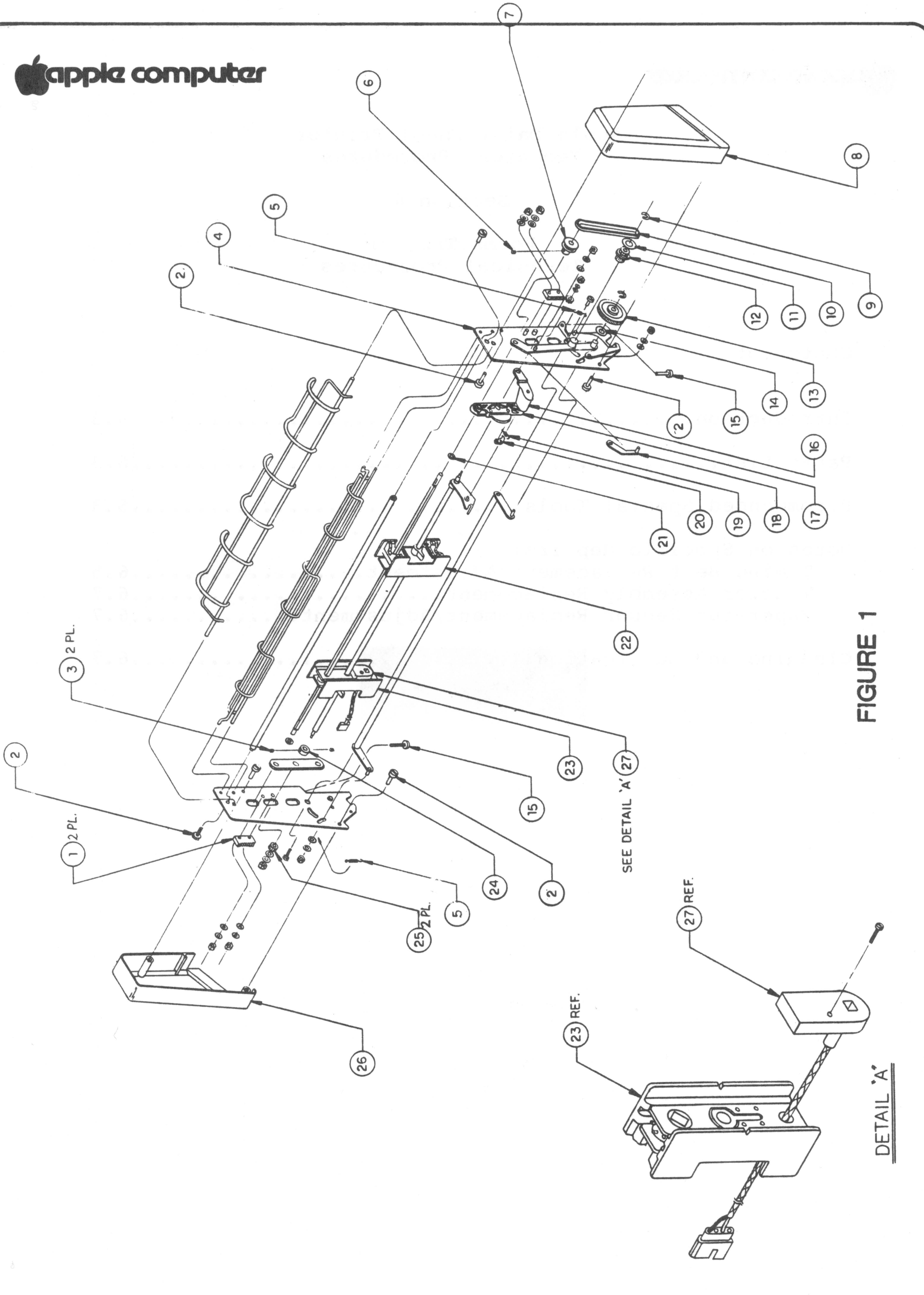


FIGURE 1

DETAIL 'A'

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INTRODUCTION

The exploded drawing on the left shows the DWP Forms Tractor (DWP-FT). All parts available to Level One Service Centers are listed below, and are pointed out on the drawing. Replacement of these parts is optional at Level One: there is no spares kit, and any failed DWP-FT may be shipped to the Level Two Service Center for repair, using Apple P/N 668-94510 (defective unit) and standard RMA procedure for "out-of-box failures". If you choose to do repairs, contact your Level Two Service Center for prices of piece parts.

The table below lists the parts on the diagram, ordered by their number on Figure 1. Special tools you will need for piece repairs are listed below the table.

Table 1

Number	Description	Apple Part No.
1	Rack, Adjust	970-0500
2	Screw, #8-32 x 1/2 SEMS	970-0562
3	Scr, #6-32 x 1/8 Splined	970-0525
4	Side Plate Assy, R.H.	699-0122
5	Spring, Extension	970-0517
6	Scr, #8-32 x 1/8 Splined	970-0526
7	Pulley, 30 Groove	970-0516
8	Cover, R.H.	970-0548
9	E-Ring, 5133-37	970-0524
10	Timing Belt	970-0537
11	Shoulder, Pulley	970-0511
12	Gear, Pulley	970-0515
13	Gear, Idler	970-0514
14	Washer, Thrust	970-0538
15	Stud, Adjust	970-0503
16	Lever, Adjust	970-0513
17	Plate, Ratchet	970-0512
18	Arm, Tension	970-0510
19	Spring, Extension	970-0519
20	Pawl, Ratchet	970-0509
21	Washer, Thrust	970-0534
22	Tractor Assembly, R.H.	699-0123
23	Tractor Assembly, L.H.	699-0124
24	Collar	970-0501
25	Pinion, Adjust	970-0502
26	Cover, L.H.	970-0551
27	Switch/Brkt Assy	699-0125

RECOMMENDED SPECIAL TOOLS

.072" spline wrench (size DS), six-flute
.096" spline wrench (size DS), six-flute

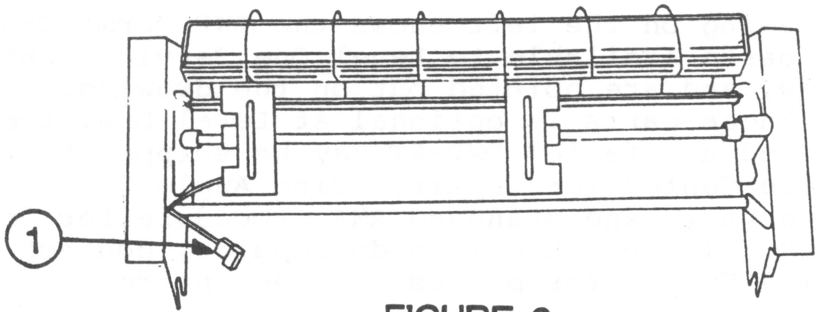


FIGURE 2

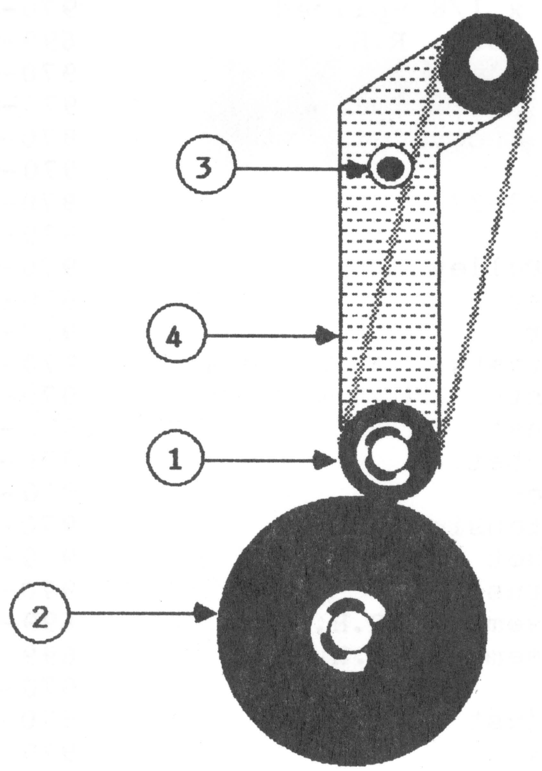


FIGURE 3

NOTES ON SPECIFIC PROCEDURES

A. Timing Belt Replacement/Adjustment

Tools: Medium flatblade screwdriver, 1/4 inch wrench, DWP spring gauge, ruler.

1. Carefully unplug the connector at the left of the Forms Tractor (Figure 2, #1) from the printer, and then lift the Forms Tractor from the DWP.

2. Move the right-hand tractor assembly next to the left hand assembly, so that it is out of the way for the next step. (There is a position-lock lever in the middle of each tractor assembly. To move the assembly, release the lever.)

3. Remove the two screws that hold the right-hand side cover and remove the cover.

4. Remove the E-ring and the black plastic washer from the lower drive-belt gear (Figure 3, #1)

5. Slip the timing belt off its gears.

6. Slip the new belt over the upper gear, then the lower.

7. Reinstall the black plastic washer and the E-ring on the lower gear.

Adjusting the Timing Belt

A new timing belt should be adjusted so that there is neither binding nor backlash: that is, the gears that drive the belt (Figure 3, #1 and 2) should turn easily but without any appreciable free play between their teeth. This adjustment should also be performed if any Forms Tractor shows symptoms of binding or backlash such as uneven line feeding (poor vertical registration) or failure to advance paper.

1. Remove the right-hand cover, as in the procedure above.

2. Using a 1/4-inch wrench, loosen the nut on the sliding arm under the timing belt (Figure 3, #3).

3. Grasping the lower pulley, move the sliding arm (Figure 3, #4) until the belt feels taut. Tighten the nut. Then test the tension by lining up a ruler with one side of the belt and pushing on the belt with a spring gauge until the gauge registers 1/2 lb. The belt should be deflected 1/4", + or - 1/8". Readjust if necessary.

Then try out the tractor on the DWP to check for binding or backlash. If all is well, put the side cover back on.

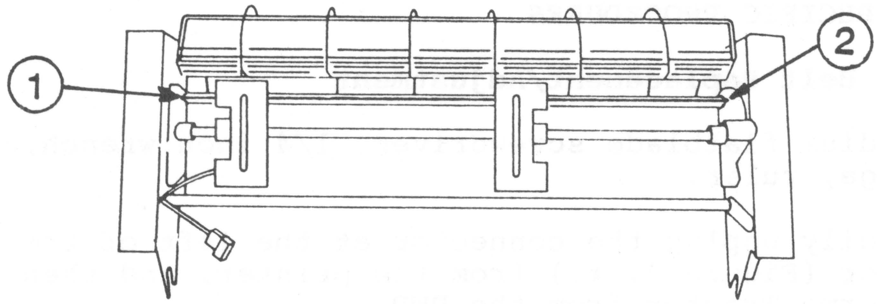


FIGURE 4

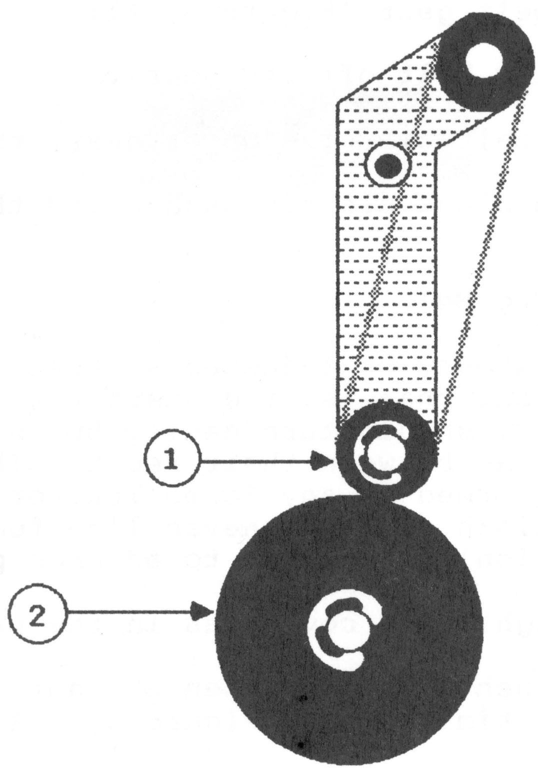


FIGURE 5

B. Tractor Assembly Replacement

Apple recommends that you let Level 2 centers perform this replacement. To remove the tractors, you must first remove the pinion at the end of the round central shaft. The pinion is press-fitted on to the tapered end of the shaft; it requires a wheel puller for removal.

C. Paper-out Sensor Replacement/Adjustment

Apple recommends that you let Level 2 centers replace the paper-out sensor. If the sensor should come loose, you can re-glue it to the Forms Tractor with Loctite #6 or equivalent fast-drying bonding agent. To position the sensor correctly for regluing, follow these steps.

1. With the DWP power on and the Forms Tractor installed, load 16-lb. paper into the Forms Tractor. If the sensor is too loose, the paper will not trip the sensor switch. As a result, the Attend Light on the front panel of the DWP will go on and the printer will stop printing.

2. Move the sensor against the paper until the Attend Light on the DWP goes off. (This indicates that the sensor switch "senses" the paper.) Mark this position on the left hand tractor assembly. Then apply glue and position the sensor.

CLEANING AND LUBRICATION

If the plastic surfaces of the DWP-FT become soiled, use Formula 409 or any mild soap solution to clean them. Lubricate the Forms Tractor with Tellus oil (Apple P/N 970-0006). Every 18 months, put one drop of oil on each location pointed out in Figures 4 and 5 (see instructions below). In harsh environments and heavy usage applications, more frequent lubrication may be necessary.

1. Remove the forms tractor from the printer.

2. Put one drop of Tellus oil at each end of the square drive shaft (see Figure 4, #1 and #2).

3. Remove the right side cover of the forms tractor.

4. Remove the E-ring from the lower timing belt gear (Figure 5, #1). Remove the gear and put one drop of Tellus oil on the metal shaft.

5. Remove the E-ring from the idler gear (Figure 5, #2). Remove the gear and put one drop of oil on the shaft.

6. Replace both gears and E-rings.

9. Tractor Assembly Replacement

Apple recommends that you let Level 2 centers perform this replacement. To remove the tractors, you must first remove the [illegible] at the end of the [illegible] control shaft. The pinion is [illegible] on the tractor end of the shaft. It requires a wheel puller for removal.

[illegible] Tractor Replacement/Adjustment

Apple recommends that you let Level 2 centers replace the [illegible]. If the sensor should come loose, you can [illegible] it [illegible]. The lever will [illegible] on the [illegible] to position the sensor correctly [illegible] behind the [illegible] tape.

[illegible] with the [illegible] and the forms tractor installed, [illegible] into the forms tractor. If the sensor [illegible] will [illegible] the sensor switch [illegible] the front panel of the [illegible] will stop printing.

[illegible] the paper until the [illegible] that the sensor [illegible] apple [illegible]

[illegible]

apple computer

Apple Daisy Wheel Printer
Technical Procedures

Section 7

Mechanical Cut Sheet Feeder
Technical Procedures

Contents:

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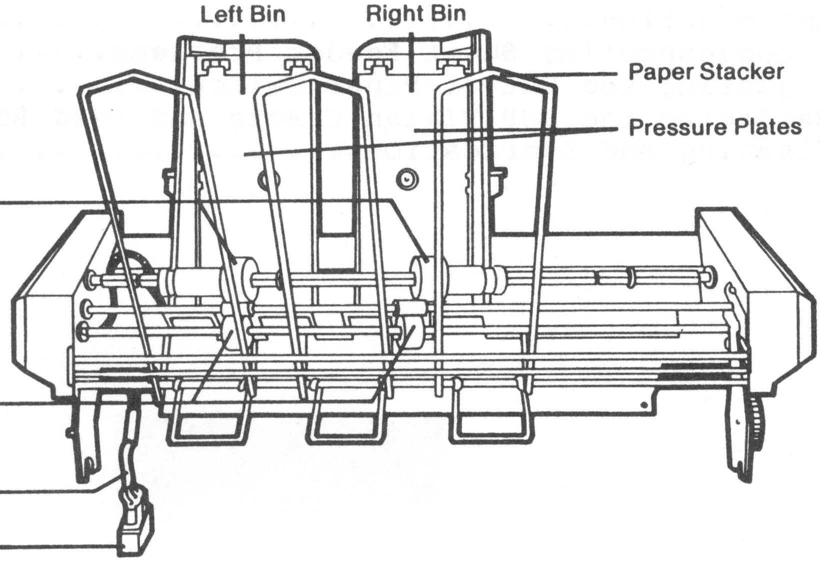


FIGURE 1

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INTRODUCTION

For installation and removal procedures, see the **Apple Mechanical Cut Sheet Feeder User's Manual.**

Early model DWPs may have the following problems using a Sheet Feeder:

1. ROM version 1.6 or earlier may cause Sheet Feeder malfunctions. (To determine what version is installed, run the DWP Terminal Self-Test.) Main PCB ROMs should be upgraded to Software Version 1.7 in order to use the Sheet Feeder; the ROMs are packaged with the Sheet Feeder.

2. On some early machines, the feed rollers and the platen cradle may be incompatible with Sheet Feeder operation and will cause folding and/or tearing of the top edge of the paper. In such a case, if adjustment of the Sheet Feeder's support feet does not remedy the situation, the cradle and feed rollers must be replaced; the procedure is on p. 7.11. The Troubleshooting section (p. 7.5) tells how to deal with these situations.

3. Very early DWPs may need to have Paper-Out Sensor Retrofit Kits (P/N 672-8011) installed, if they lack the connector for the Out-of-Paper switch cable. Instructions are packed with the Kit.

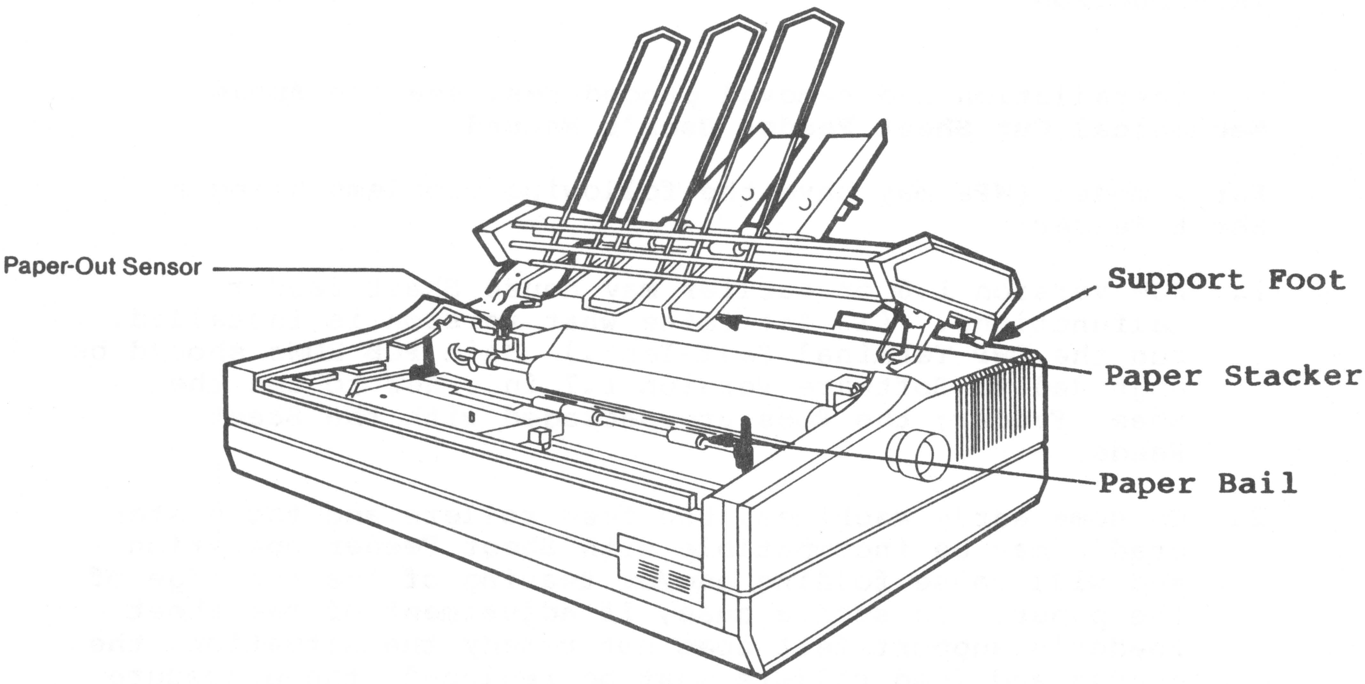


FIGURE 2

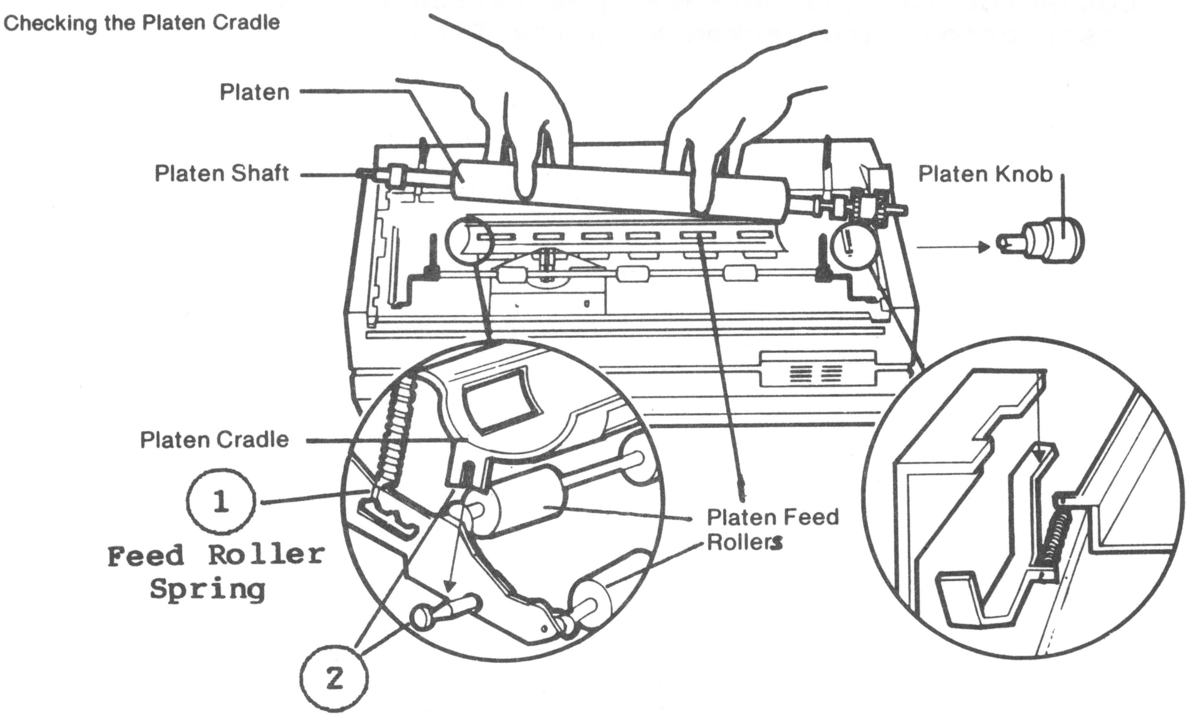


FIGURE 3

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TROUBLESHOOTING

A. Top edge of paper folds, tears.

1. Adjust the Sheet Feeder's support feet to change the angle of feed. **CAUTION:** Make sure that the paper stacker does not interfere with the movement of the paper bail (see Figure 2).

2. Remove the DWP access cover, Sheet Feeder, DWP top cover and platen. Check the platen cradle and feed rollers (see Figure 3):

   - cradle seated correctly? The notched ends of the cradle should sit squarely on the pins at the end of the feed roller assemblies. (See Figure 3, #2.)

   - feed rollers jammed? Remove jam.

   - feed rollers bent, damaged? Replace rollers.

   - If cradle is seated correctly and rollers are not jammed or damaged, but paper still tears or folds, **and if this is a DWP purchased before October 1983**, then replacing the cradle and the front and rear feed rollers at the locations where the folding or tearing occurs **may** solve the problem. (See p. 7.11 for replacement procedure. Before deciding which sets of rollers to replace, check both sets of rollers by feeding 11 inch paper sideways, to see if rollers on the right side also cause folding/tearing.)

B. Paper skews to one side and/or develops wrinkles when exiting from platen

1. Make sure paper stacker is correctly seated and thumb screws are tight (see Sheet Feeder User's Manual, p. 4).

2. Make sure platen and cradle are correctly seated.

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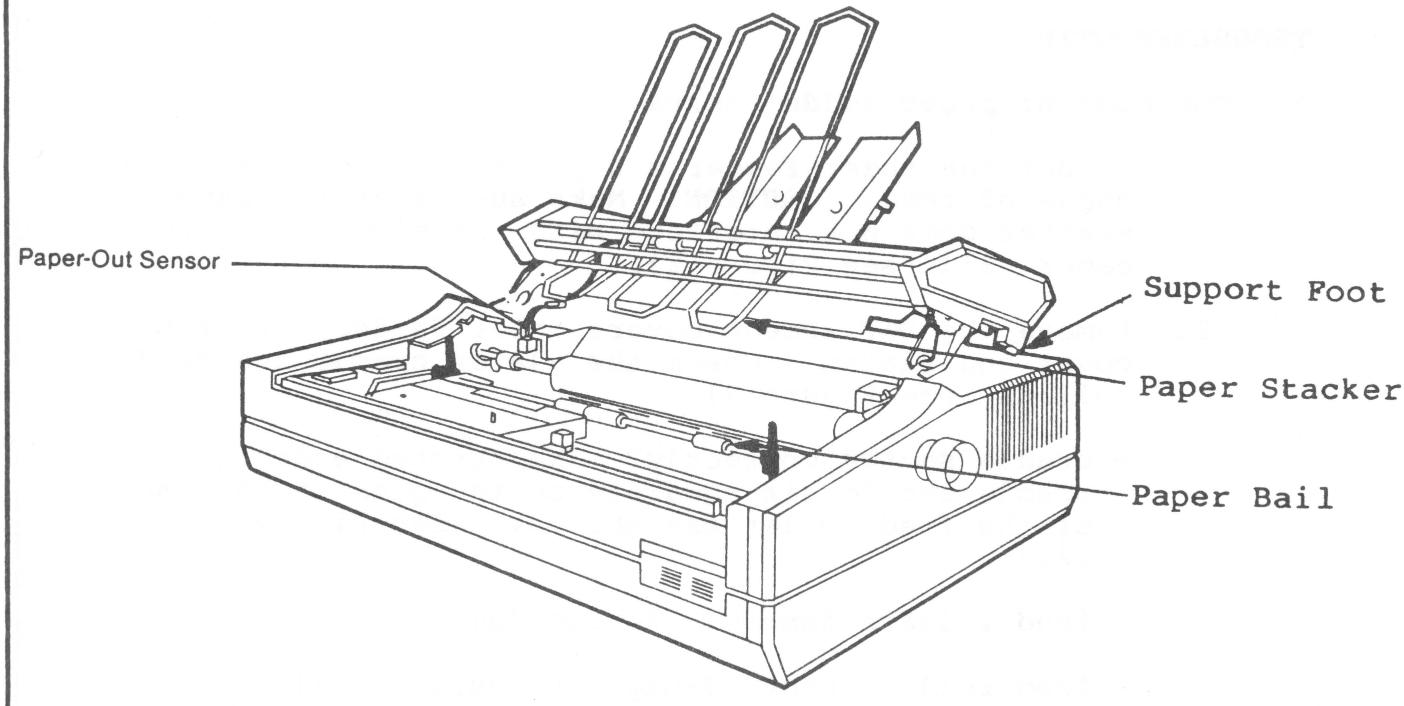


FIGURE 2

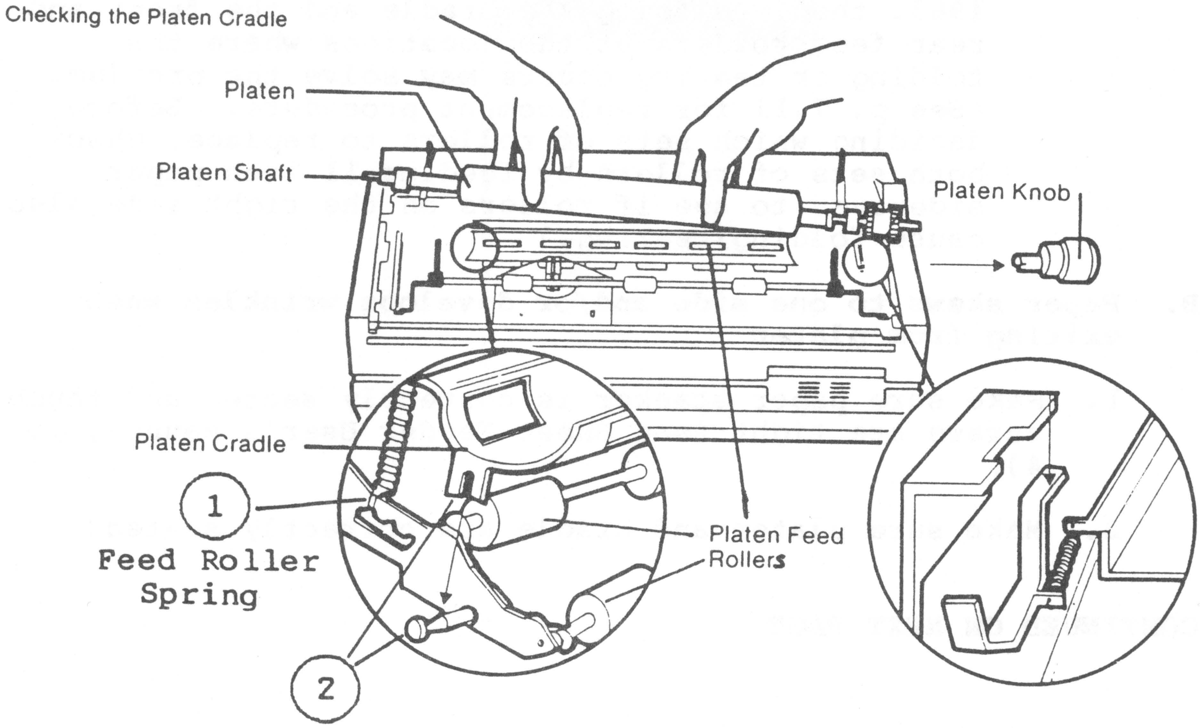


FIGURE 3

C. **Paper does not feed**

1. Is Out-of-Paper switch connected? If not, connect it.

2. Run DWP Terminal Self-Test (see BASICS) to check Software Version. If Software Version is 1.6 or earlier, replace main PCB ROMs with version 1.7 ROMs.

3. Make sure Paper Release lever is pushed back all the way (feed rollers engaged).

4. Make sure paper is correctly prepared for loading (fan through both ends of the paper stack; make sure paper curls toward you; remove any damaged sheets).

5. Check that the Sheet Feeder is properly installed.

6. Check that the platen cradle is seated correctly. The notched ends of the cradle should sit squarely on the pins at the end of the feed roller assemblies. (See Figure 3, #2.)

7. Check that the four feed roller springs beneath the platen are adjusted to the middle position. **NOTE:** Figure 3, #1 shows the spring adjusted to the rear position: to move the spring to the middle position, use needlenose pliers, a screwdriver blade, a good deal of force, and care.

D. **False out-of-paper indication** (paper is present, but Ready lamp blinks, Attend lamp comes on)

1. Remove Sheet Feeder and see if DWP functions correctly. If not, see DWP Troubleshooting section.

2. Adjust Out-of-Paper switch (see p. 7.9).

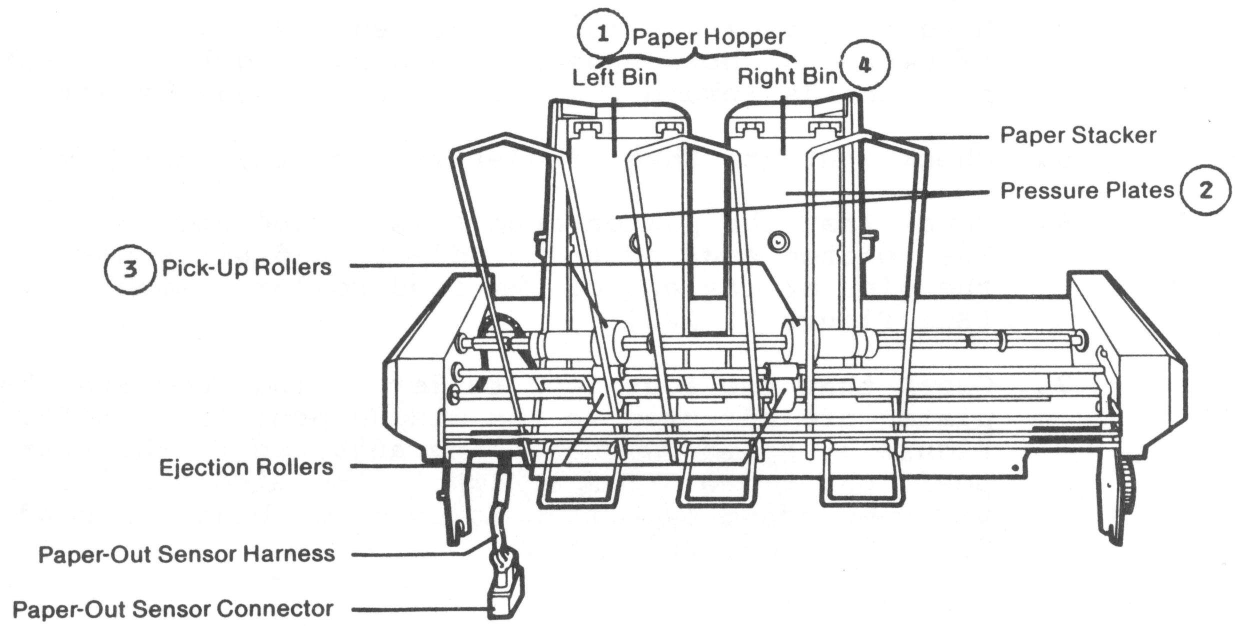

1 Paper Hopper
Left Bin
Right Bin 4
Paper Stacker
Pressure Plates 2
3 Pick-Up Rollers
Ejection Rollers
Paper-Out Sensor Harness
Paper-Out Sensor Connector

FIGURE 4

ADJUSTING THE OUT-OF-PAPER SWITCH

The Out-of-Paper (OOP) switch should cause the DWP to stop printing when the Sheet Feeder hopper is empty or when the paper is jammed. If the OOP switch does not function correctly, try to adjust it before replacing it or swapping out the Sheet Feeder. Use the following procedure.

Check the Switch:

1. With power off the DWP, remove paper from the Sheet Feeder hopper (Figure 4, #1).

2. Push the pressure plates (Figure 4, #2) back until they lock.

3. Feed a piece of 14 or 16 lb. paper between the hopper and the pick-up rollers, as if you were going to feed it to the printer by hand. Just before it reaches the platen, the paper passes the OOP switch, and at that point you should hear a "click". Try this several times, pushing the paper down and then pulling it back up. IF YOU DO **NOT** HEAR THE SWITCH CLICK, continue with this procedure. If you hear a click but the switch still does not work, misadjustment is not the problem - see the Troubleshooting section (p. 7.7) for further information.

If the switch does not click when paper is installed:

1. With the Sheet Feeder removed from the DWP, follow the OOP cable until you locate the OOP switch at the back of the Sheet Feeder.

2. Push the right paper bin (Figure 4, #4) as far right as possible, to give yourself room for the next steps.

3. Loosen but do not remove the two OOP switch screws, using a small screwdriver.

4. Move the OOP switch as you insert and remove a sheet of light paper (14-16 lb.). When inserting/removing the paper causes the switch to click, tighten the screws.

5. Install the Sheet Feeder on the DWP, load a small stack of paper, and test whether printing occurs normally when paper is present and stops (and the Attend lamp comes on) when the paper hopper is empty. If so, you have corrected the problem. If not, replace the switch or the entire Sheet Feeder.

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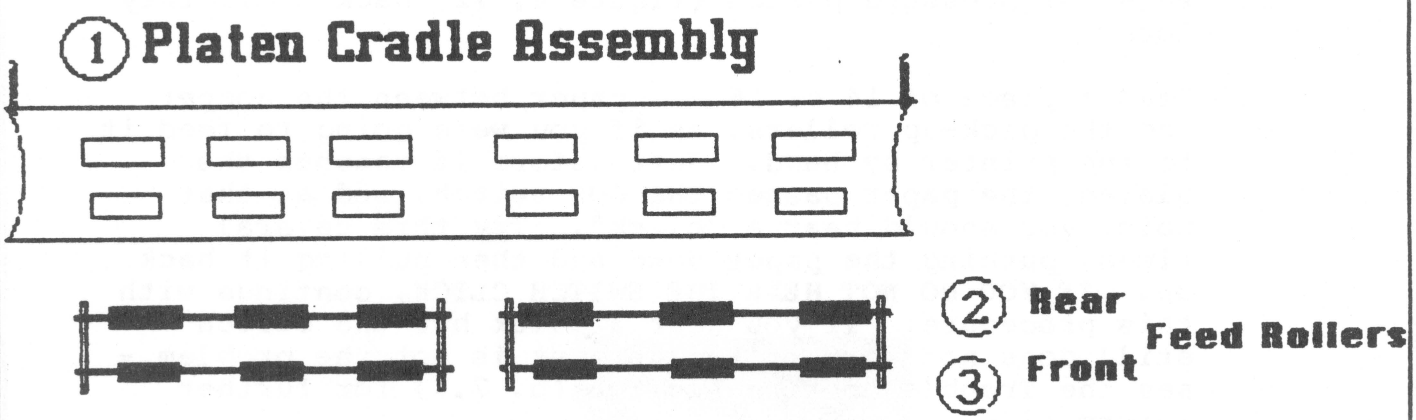


FIGURE 5

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REPLACING THE DWP PLATEN CRADLE AND FEED ROLLERS

Parts you may need (depending on the situation):

Cradle assembly: P/N 970-0608 (does not include springs) (Figure 5, #1)
Rear feed roller shaft: P/N 970-0015 (Figure 5, #2)
Front feed roller shaft: P/N 970-0014 (Figure 5, #3)

1. Disconnect the AC power cord from the DWP.

2. Remove the top cover and the platen.

3. Lift the cradle gently forward and up off its pins, and rest it upside down on the metal rods behind it.

4. To replace either set of feed rollers:

   a) Grasp the front roller shaft and push gently against one side-plate until the roller shaft comes free.

   b) Grasp the rear roller shaft and move one side-plate forward while pushing out on it, until the roller comes free.

   c) Install the new **rear** (larger) roller shaft first, then the new **front** (smaller) roller shaft.

5. To replace the cradle:

   a) Start with the cradle in normal position, seated on the feed rollers.

   b) Use your fingers or a bent paper clip or equivalent to remove the small springs from the sides of the cradle. (Leave the other side of the springs attached to the DWP.)

   c) Remove the old cradle and put the new one in place. Attach the springs.

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CLEANING AND LUBRICATION

1. If the plastic surfaces of the Sheet Feeder become soiled, use Formula 409 or any mild soap solution to clean them.

2. Every 2000 sheets of paper, the rubber rollers should be cleaned with Fedron (**sparingly**).

3. Every 18 months, put one drop of Tellus oil (Apple P/N 970-0006) on each of the following five locations:

   - Both ends of the square shaft (Figure 6, #1)

   - Both ends of the front round shaft (Figure 6, #2)

   - The inner gear of the square shaft (Figure 6, #3). To reach the inner gear of the square shaft, remove the two black Phillips screws from the right side plate and remove the plastic side cover. Then put one drop of Tellus oil on the bearing at the end of the square shaft.

NOTE: In harsh environments and heavy usage applications, more frequent lubrication may be necessary.

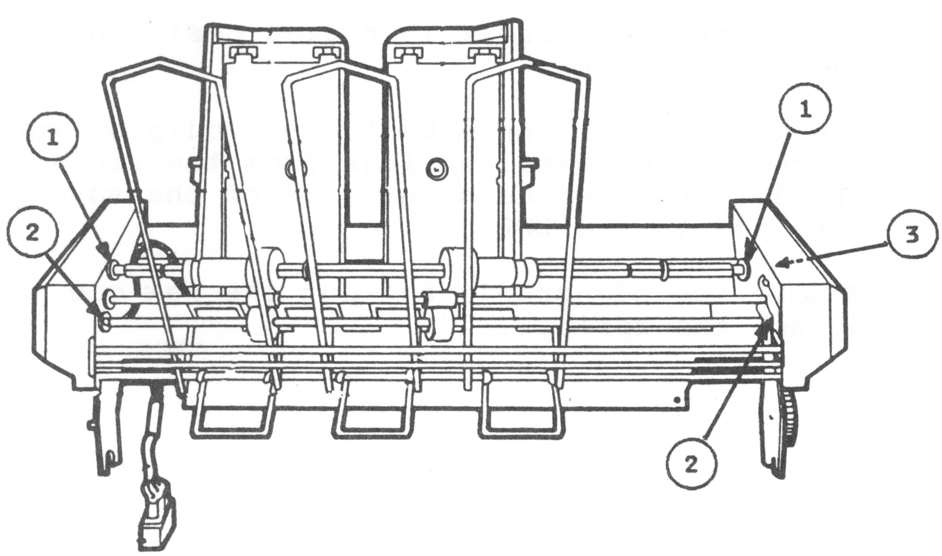


FIGURE 6

Figure 2 - Hopper Assembly, Left Hand

Item #	Description	Apple Part No.
2-1	Hopper, L.H.	970-0674
2-2	Pressure Plate Latch, L.H.	970-0676
2-3	Spring, Extension	970-0656
2-4	Spring, Hopper	970-0706
2-5	Screw, #4-40 X .187	970-0670
2-6	Lockwasher, Int. Tooth	970-0664
2-7	Screw, #2-56 X .437	970-0657
2-8	OOP/Jam Switch Assy	970-0684
2-9	Insulator, OOP Switch	970-0671
2-10	Spring, Compression	970-0694
2-11	Cork	970-0679
2-12	Corner Separator, L.H.	970-0678
2-13	Stand-Off	970-0696
2-14	Nut Plate	970-0704

Figure 3 - Hopper Assembly, Right Hand

Item #	Description	Apple Part No.
3-1	Hopper, R.H.	970-0673
3-2	Pressure Plate Latch, R.H.	970-0675
3-3	Stand-Off	970-0696
3-4	Spring, Extension	970-0656
3-5	Corner Separator, R.H.	970-0677
3-6	Cork	970-0679
3-7	Spring, Compression	970-0694
3-8	Screw, #4-40 X .187	970-0670
3-9	Spring, Hopper	970-0706

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Apple Daisy Wheel Printer Technical Procedures

Section 8

Illustrated Parts List

The figures and lists below include all piece parts that can be purchased separately from Apple for the Daisy Wheel Printer, along with their part numbers. These are the only parts available from Apple. Refer to your Apple Service Programs manual for prices.

Contents:

REV.	ZONE	ECO #	REVISION	APPD	DATE

NOTE: UNLESS OTHERWISE SPECIFIED

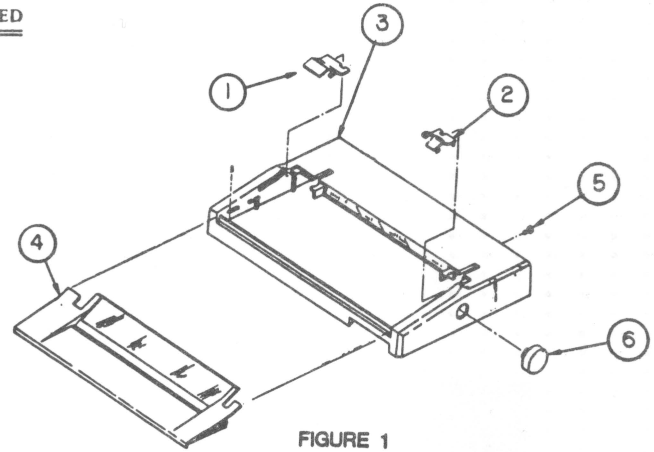


FIGURE 1

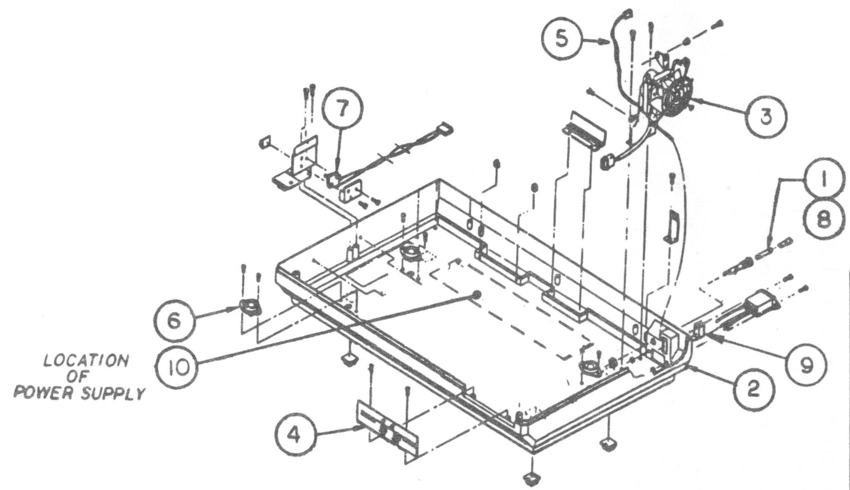


FIGURE 2

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TITLE ILLUSTRATED PARTS LIST DWP

SIZE B | DRAWING NUMBER 070-0229 - A | SHT 1/7

DRAWING NUMBER 070-0229-A SHT 1/7

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DAISY WHEEL PRINTER, TOP COVER ASSEMBLY (Figure 1)

Item	Part No.	Description
1	970-0044	Door, Tractor Cover Left
2	970-0045	Door, Tractor Cover Right
3	970-0043	Cover, Top
4	699-0106	Panel Assembly, Access
5	970-0624	Screw, Plastic (covers)
6	970-0002	Knob, Platen

DAISY WHEEL PRINTER, BOTTOM COVER ASSEMBLY (Figure 2)

Item	Part No.	Description
1	740-0103	Fuse, 5 Amp 3AG (110V)
2	970-0042	Cover, Bottom
3	970-0038	Fan Assembly, Mini-Intake
4	970-0580	P. C. B., Front Panel Indicator
5	699-0102	Resistor Assembly, Hammer
6	970-0036	Shock Mount
7	970-0037	Switch, Cover Interlock
8	740-0102	Fuse, 3 Amp 3AG (220V), (for European DWP)
9	970-0010	Switch, AC Line
10	661-75088	DWP Power Supply, 115V

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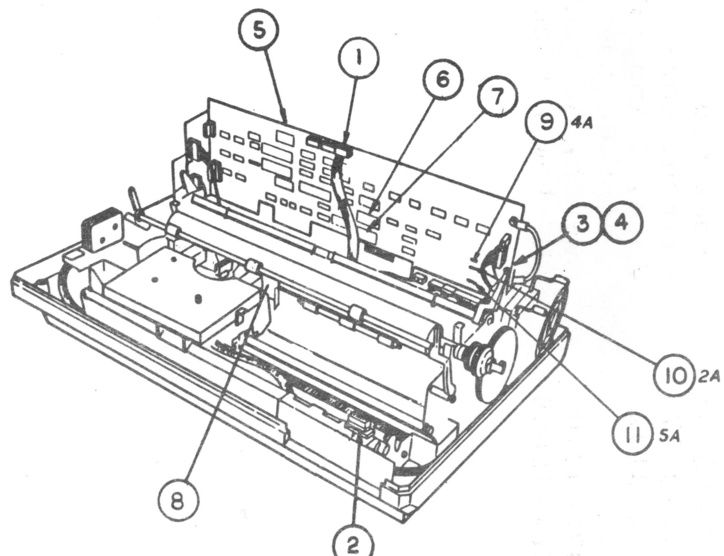


FIGURE 3

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SIZE B | DRAWING NUMBER 070 0229 A | SHT 2/7

DRAWING NUMBER 070-0229-A SHT 2/7

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A10087

DAISY WHEEL PRINTER, PRINTER LAYOUT (Figure 3)

Item	Part No.	Description
1	970-0581	Cable Assembly, Front Panel
2	970-0582	DIP Switch, Rocker Type
3	970-0618	Fastener, Grommet (PCB)
4	970-0619	Fastener, Plunger (PCB)
5	661-75087	PCB, Main Logic Card
6	342-0173	IC, 2764 8K x 8 EPROM (1.7), U43
7	342-0174	IC, 2764 8K x 8 EPROM (1.7), U44
8	699-0103	Shield Assembly Ribbon
9	740-0031	Fuse, Pico 4 Amp (F1)
10	740-0030	Fuse, Pico 2 Amp (F2)
11	740-0032	Fuse, Pico 5 Amp (F3)

NOTE: UNLESS OTHERWISE SPECIFIED

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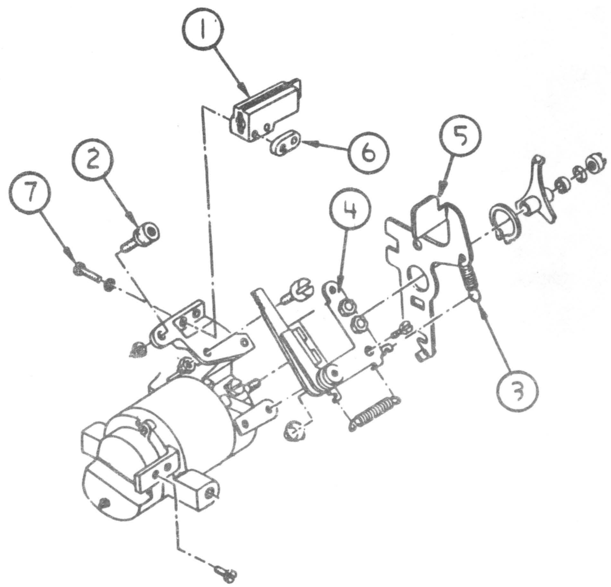


Figure 4

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TITLE ILLUSTRATED PARTS LIST DMP

SIZE	DRAWING NUMBER	SHT
B	070-0229-A	3/7

DRAWING NUMBER 070-0229-A SHT 3/7

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DAISY WHEEL PRINTER, PRINTWHEEL MOTOR ASSEMBLY (Figure 4)

Item	Part No.	Description
1	970-0003	Hammer Assembly complete
2	970-0013	Bumper, Hammer Armature
3	970-0018	Spring, Extension (Printwheel Motor Latch)
4	699-0099	Armature, Hammer Assembly
5	970-0022	Latch, Printwheel Motor
6	970-0613	Nut Plate, Hammer
7	970-0623	Screw 3-48 X .625

NOTE: UNLESS OTHERWISE SPECIFIED

REV.	ZONE	ECO #	REVISION	APPD	DATE

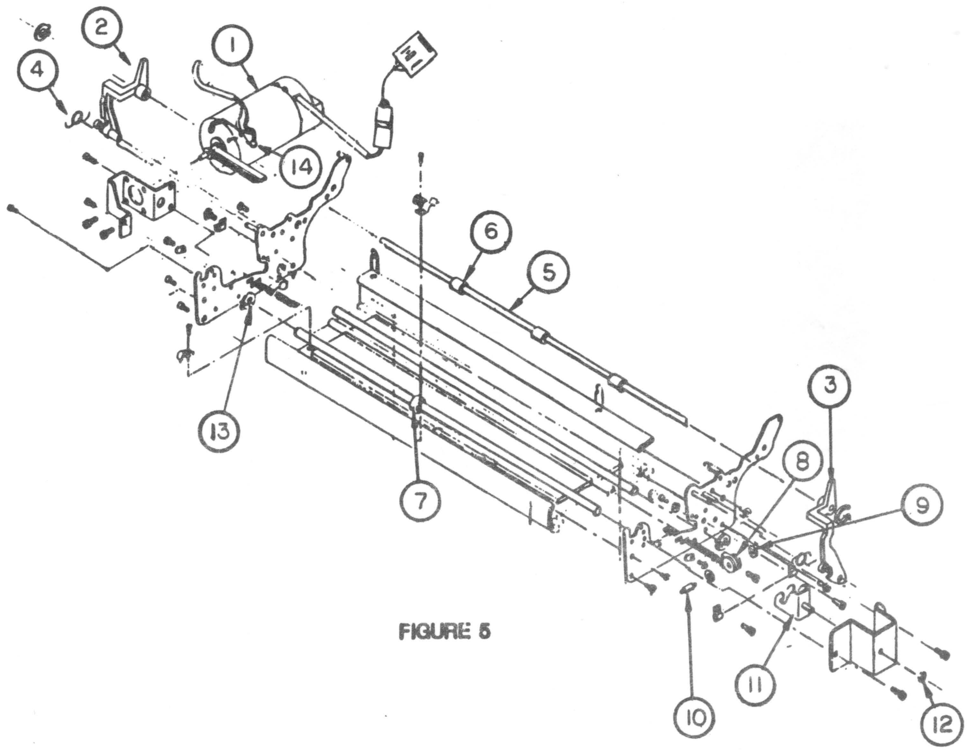


FIGURE 5

METRIC

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TITLE ILLUSTRATED PARTS LIST DWP

SIZE B | DRAWING NUMBER 070-0229 – A | SHT 4/7

DRAWING NUMBER 070-0229-A SHT 4/7

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DAISY WHEEL PRINTER, CARRIAGE DRIVE MECHANISM (Figure 5)

Item	Part No.	Description
1	661-75090	Motor, Carriage Drive complete
2	970-0040	Lever, Paper Bail Left
3	970-0041	Lever, Paper Bail Right
4	970-0622	Spring, Extension (paper bail)
5	970-0031	Shaft, Paper Bail
6	970-0019	Roller, Paper Bail (rubber)
7	970-0030	Bearing, Spherical
8	970-0005	Pulley, Idler Assembly
9	970-0029	Washer, Thrust
10	970-0028	Shaft, Pulley Assembly
11	970-0027	Bracket, Pulley Adjust
12	970-0085	Nut, #8 Hex Lock
13	970-0607	Grip Ring
14	970-0621	Capacitor, Carriage Motor

NOTE: UNLESS OTHERWISE SPECIFIED

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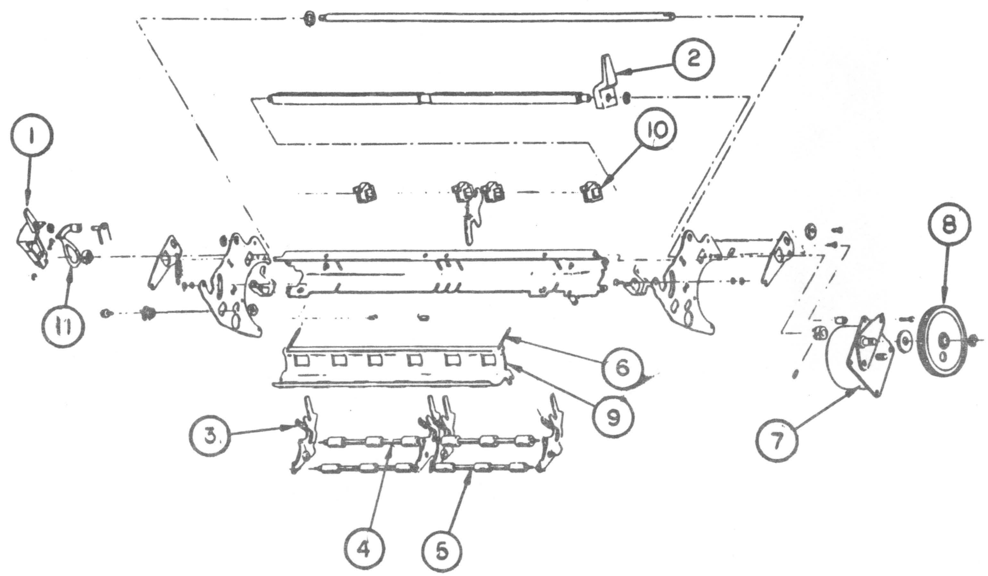


FIGURE 6

METRIC

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DRAWING NUMBER 070-0229 -A SHT 5/7

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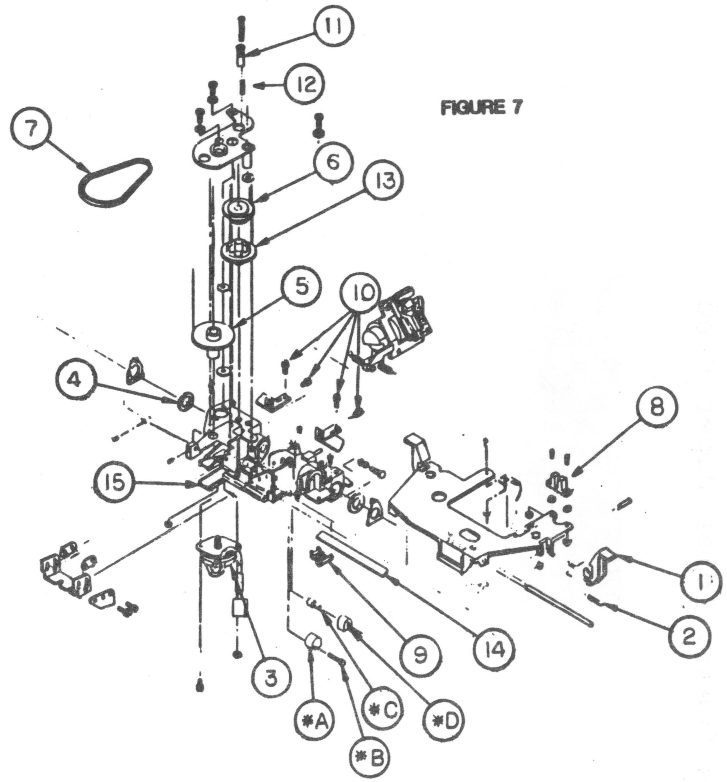
DAISY WHEEL PRINTER, PAPER FEED MECHANISM (Figure 6)

Item	Part No.	Description
1	970-0026	Lever Arm, Impression Control
2	970-0025	Lever Arm, Feed Roller Release
3	970-0023	Spring, Extension (feed roller)
4	970-0015	Shaft, Rear Feed Roller
5	970-0014	Shaft, Front Feed Roller
6	970-0020	Spring, Extension (cradle)
7	699-0104	Stepper Motor, Paper Feed
8	970-0017	Gear, Platen Idler*
9	970-0608	Cradle Assembly
10	970-0610	Cam Feed Roller
11	970-0606	Spring, Extension (Impression Control Lever)

* - Same as "Gear, Idler Paper Feed"

NOTE: UNLESS OTHERWISE SPECIFIED

FIGURE 7



REV.	ZONE	ECO #	REVISION	APPD	DATE

METRIC

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TITLE: ILLUSTRATED PARTS LIST DWP

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DRAWING NUMBER 070-0229-A SHT 6/7

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DAISY WHEEL PRINTER, CARRIAGE ASSEMBLY (Figure 7)

Item	Part No.	Description
	661-75089	Carriage Assembly, Complete
1	970-0032	Latch, Ribbon Box
2	970-0024	Spring, Extension (ribbon latch)
3	970-0034	Stepper Motor, Ribbon Feed
4	970-0004	Felt Wiper, Carriage
5	970-0033	Pulley Assembly, Ribbon Rewind
6	970-0076	Drive Gear, Ribbon Clutch
7	970-0079	Drive Belt, Ribbon Rewind
8	970-0021	Photon Module (End of Ribbon)
9	970-0612	Cleat, Belt
10	970-0614	Screw 4-40 X 5/16 SEMS
11	970-0615	Drive Key, Ribbon Drive
12	970-0616	Spring, Compression (Ribbon Drive Key)
13	970-0617	Pulley, Timing (Ribbon)
14	970-0001	Drive Belt, Timing
15	970-0722	Yoke, Bearing
*A		Eccentric lobe
*B		Eccentric screw
*C		Eccentric washer
*D		Plate, Ribbon Plate Lock

* These parts are now obsolete. If one of them requires replacement, replace all four with the following new parts:

Item	Part No.	Description
*A	970-0626	Bracket, Ribbon Plate Adjust (1ea.); replaces eccentric lobe
*B	970-0625	Screw 6-32 X .562 (2ea.); replaces eccentric screw
*C	970-0628	Washer #6 (2ea.); replaces eccentric washer
*D	970-0627	Plate, Ribbon Plate Lock (1ea.); replaces eccentric lobe

NOTE: UNLESS OTHERWISE SPECIFIED

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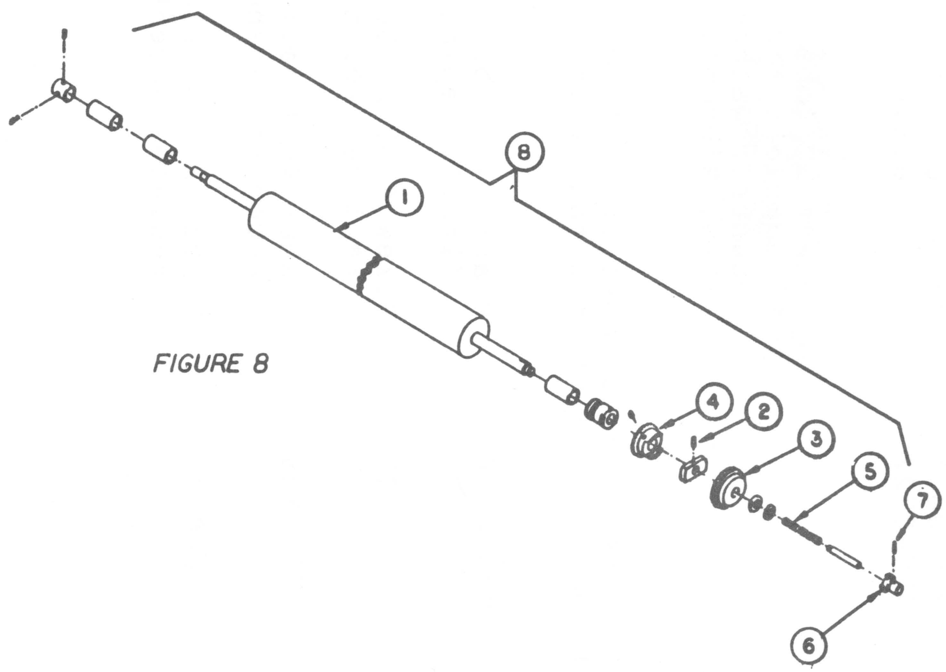


FIGURE 8

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DESIGNER / SCALE

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TITLE ILLUSTRATED PARTS LIST DWP

SIZE B | DRAWING NUMBER 070-0229 - A | SHT 7/7

DRAWING NUMBER 070-0229 - A SHT 7/7

DAISY WHEEL PRINTER, PLATEN ASSEMBLY (Figure 8)

Item	Part No.	Description
	699-0101	Platen Assembly complete
1	699-0098	Core, Platen
2	970-0035	Needle Roll
3	970-0016	Gear, Platen
4	970-0602	Gear, Tractor Drive
5	970-0603	Spring, Compression, Platen Clutch
6	970-0604	Adapter, Platen Knob
7	970-0979	Roll Pin
8	699-0101	Daisy Wheel Platen Assy

Sheet Feeder Technical Procedures

Section 9

Illustrated Parts List

The figures and lists below include all piece parts that can be purchased separately from Apple for the Sheet Feeder, along with their part numbers. These are the only parts available from Apple. Refer to your Apple Service Programs manual for prices.

Contents:

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REV.	ZONE	ECO #	REVISION	APPD	DATE

NOTE: UNLESS OTHERWISE SPECIFIED

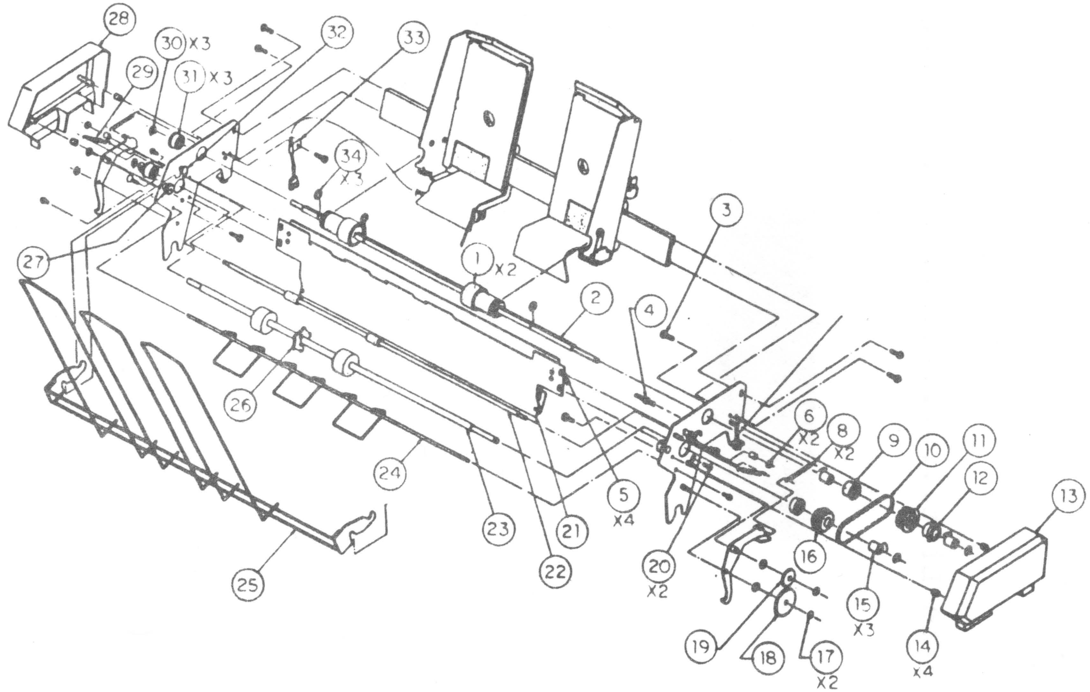


Figure 1: Sheet Feeder

TITLE	ILLUSTRATED PARTS LIST SHT. FEEDER	
SIZE	DRAWING NUMBER	SHT
B	070-0235 – A	1/2

SHEET FEEDER (Figure 1)

Item	Part No.	Description
1	970-0693	Pick-up Roller Assembly
2	970-0691	Square Shaft Assembly
3	970-0666	Stud, #8-32 Self-clinch
4	970-0702	Stud, Pinch Roller
5	970-0705	Nut, Modified
6	970-0659	E-Ring, Retainer
7	970-0503	Stud, Adjusting (foot)
8	970-0654	Spring
9	970-0690	Clutch Housing
10	970-0668	Belt, Timing
11	970-0688	Pulley
12	970-0689	Cam
13	970-0680	Cover, R.H. (Beige)
14	970-0669	Fastener, #8-18
15	970-0665	Clutch Assembly, Roller
16	970-0687	Cluster, Gear/Pulley
17	970-0660	E-Ring, Retainer
18	970-0685	Gear, Platen
19	970-0686	Gear, Idler
20	970-0672	Screw, #6-32 x 5/15 Flat Head
21	970-0703	Paper Guide Assembly
22	970-0697	Pinch Roller Assembly
23	970-0692	Ejection Roller Assembly
24	970-0698	Wire Guide
25	970-0699	Stacker
26	970-0695	Roller, Gear
27	970-0682	Thumb Knob
28	970-0681	Cover, L.H. (Beige)
29	970-0655	Spring
30	970-0662	Grip Ring, Retainer
31	970-0663	Ball Bearing
32	970-0683	Stand-off
33	970-0667	Cable Clamp, Steel
34	970-0661	E-Ring, Retainer

NOTE: UNLESS OTHERWISE SPECIFIED

REV.	ZONE	ECO #	REVISION	APPD	DATE

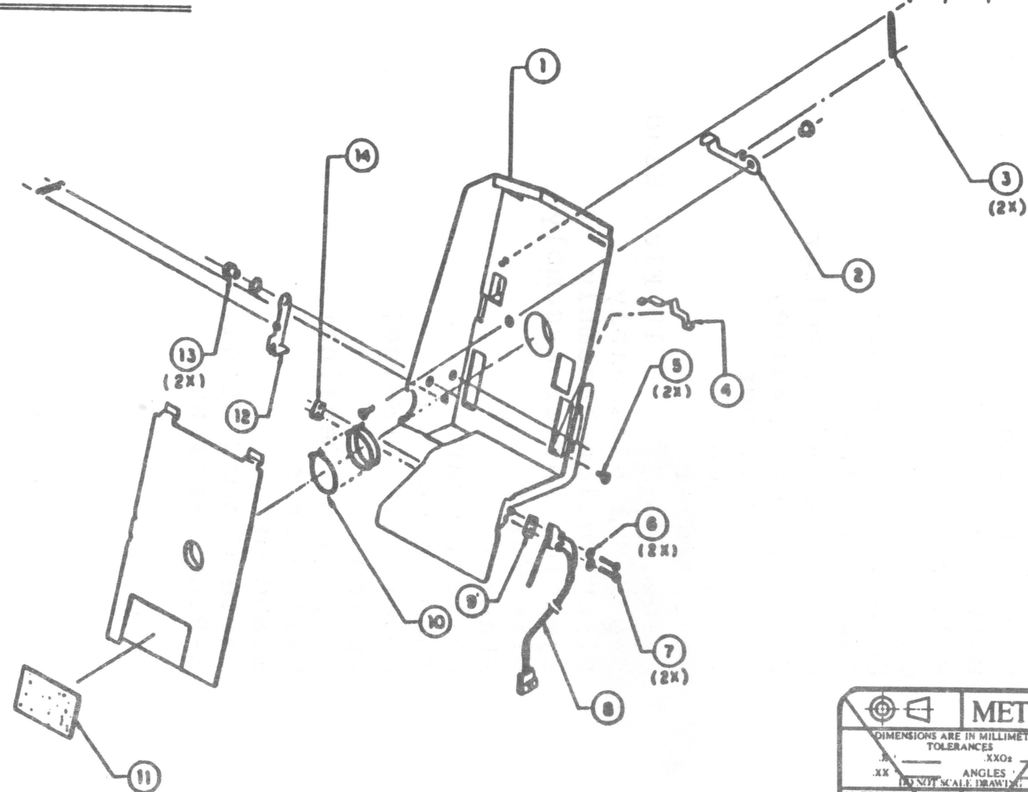


Figure 2:

Hopper Assembly, Left Hand

METRIC

DIMENSIONS ARE IN MILLIMETERS
TOLERANCES
.X ± .XX± .XXX±
ANGLES ±
DO NOT SCALE DRAWING

MATERIAL: FINISH:

DRFT | DRFT CK
ENG APPVL | MFG APPVL
RELEASE | ORIG. DIV
DESIGNER | SCALE

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TITLE ILLUSTRATED PARTS LIST SHT. FEEDER

SIZE B | DRAWING NUMBER 070 0235 A | SHT 2/2

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SHEET FEEDER, HOPPER ASSEMBLY, LEFT HAND (Figure 2)

Item	Part No.	Description
1	970-0674	Hopper, L.H.
2	970-0676	Pressure Plate Latch, L.H.
3	970-0656	Spring, Extension
4	970-0706	Spring, Hopper
5	970-0670	Screw, #4-40 x .187
6	970-0664	Lockwasher, Int. Tooth
7	970-0657	Screw, #2-56 x .437
8	970-0684	OOP/Jam Switch Assembly
9	970-0671	Insulator, OOP Switch
10	970-0694	Spring, Compression
11	970-0679	Cork
12	970-0678	Corner Separator, L.H.
13	970-0696	Stand-off
14	970-0704	Nut Plate

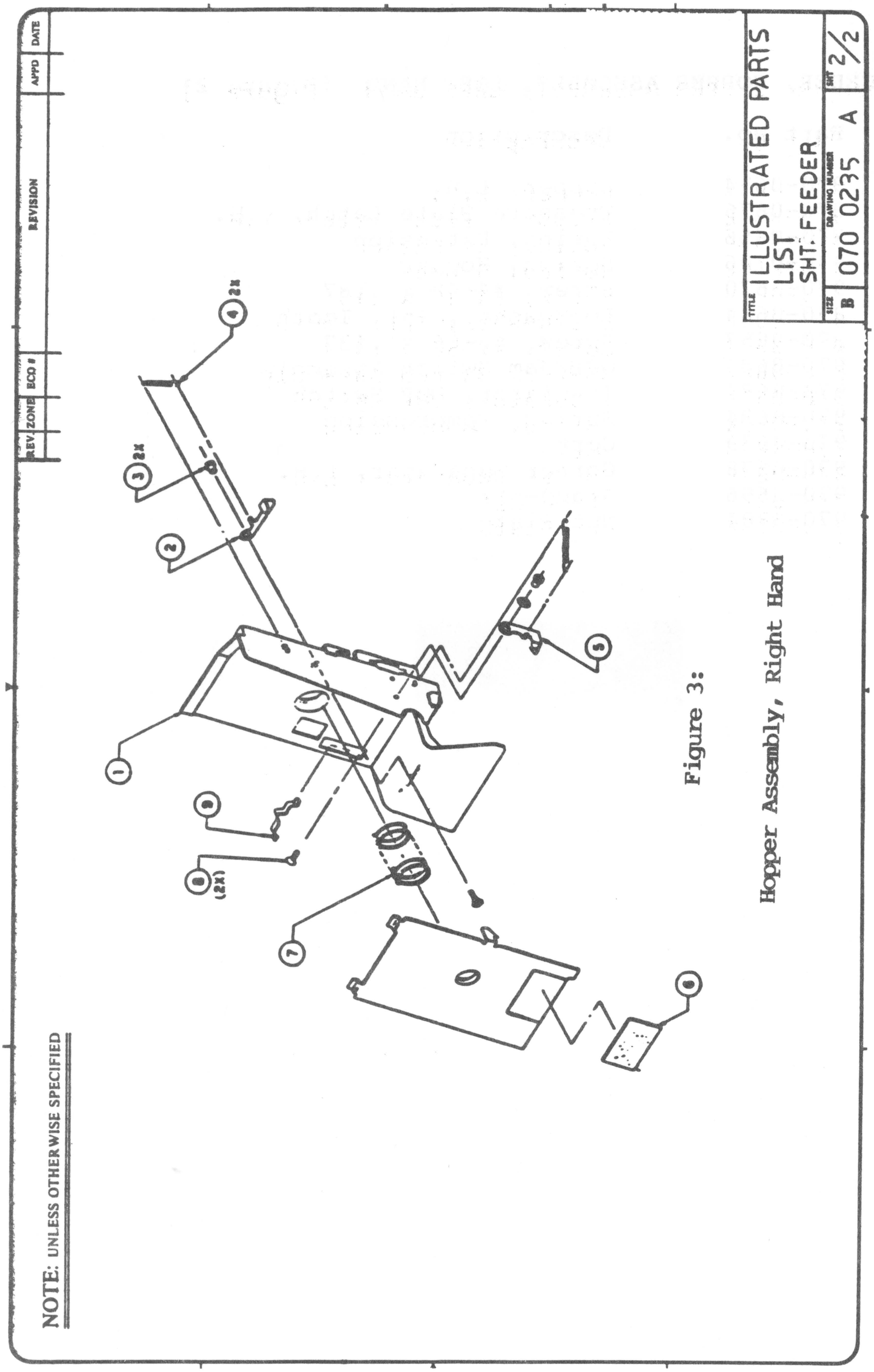


Figure 3:
Hopper Assembly, Right Hand

SHEET FEEDER, HOPPER ASSEMBLY, RIGHT HAND (Figure 3)

Item	Part No.	Description
1	970-0673	Hopper, R.H.
2	970-0675	Pressure Plate Latch, R.H.
3	970-0696	Stand-off
4	970-0656	Spring, Extension
5	970-0677	Corner Separator, R.H.
6	970-0679	Cork
7	970-0694	Spring, Compression
8	970-0670	Screw, #4-40 x .187
9	970-0706	Spring, Hopper

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Daisy Wheel Printer Technical Procedures

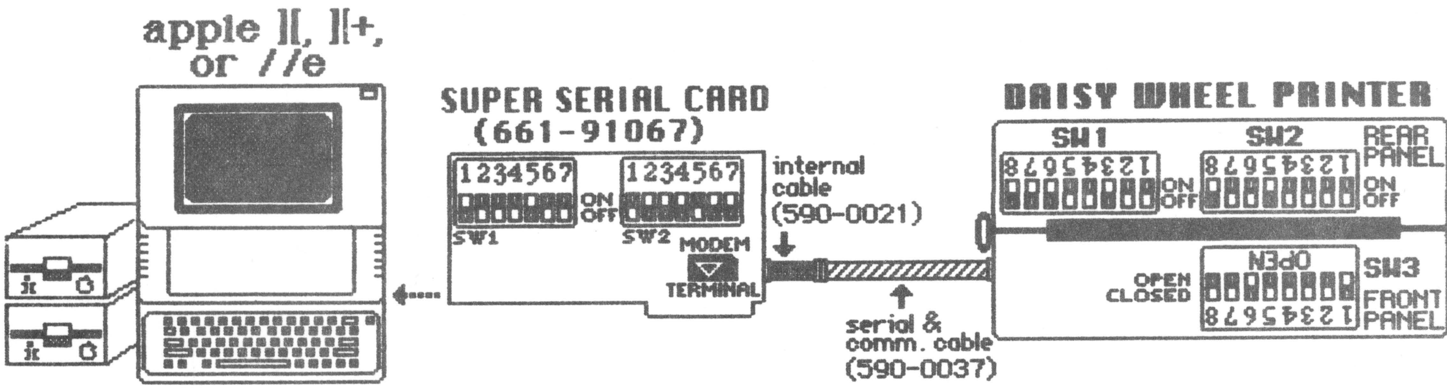
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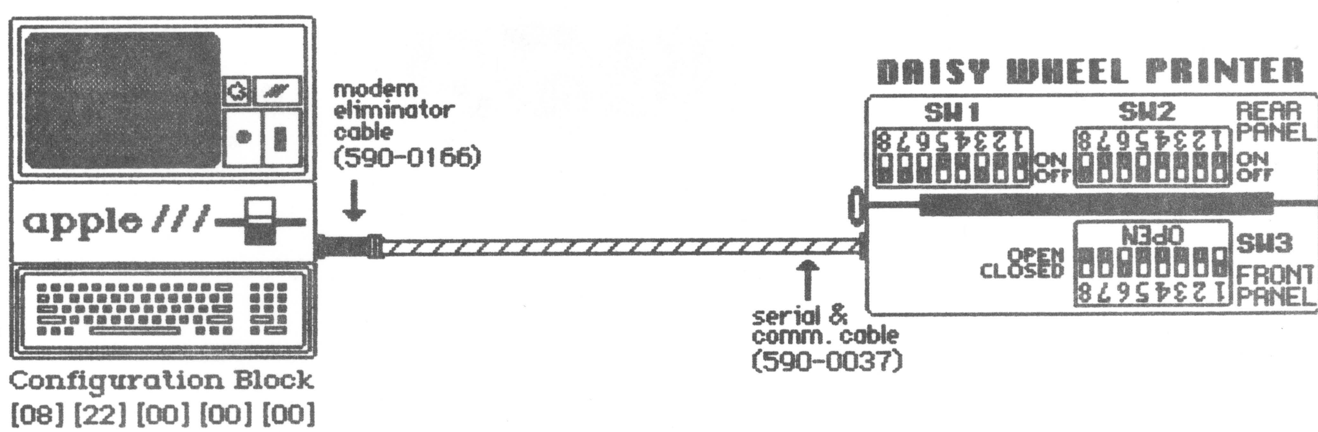
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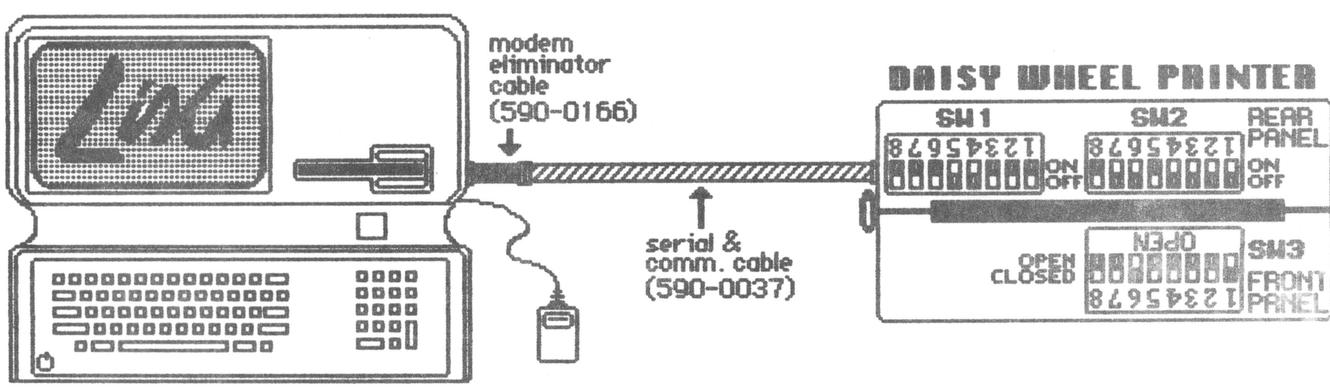
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Daisy Wheel Printer Configuration







Apple Daisy Wheel Printer
Technical Procedures

Appendix A

Illustrated Parts List

Contents

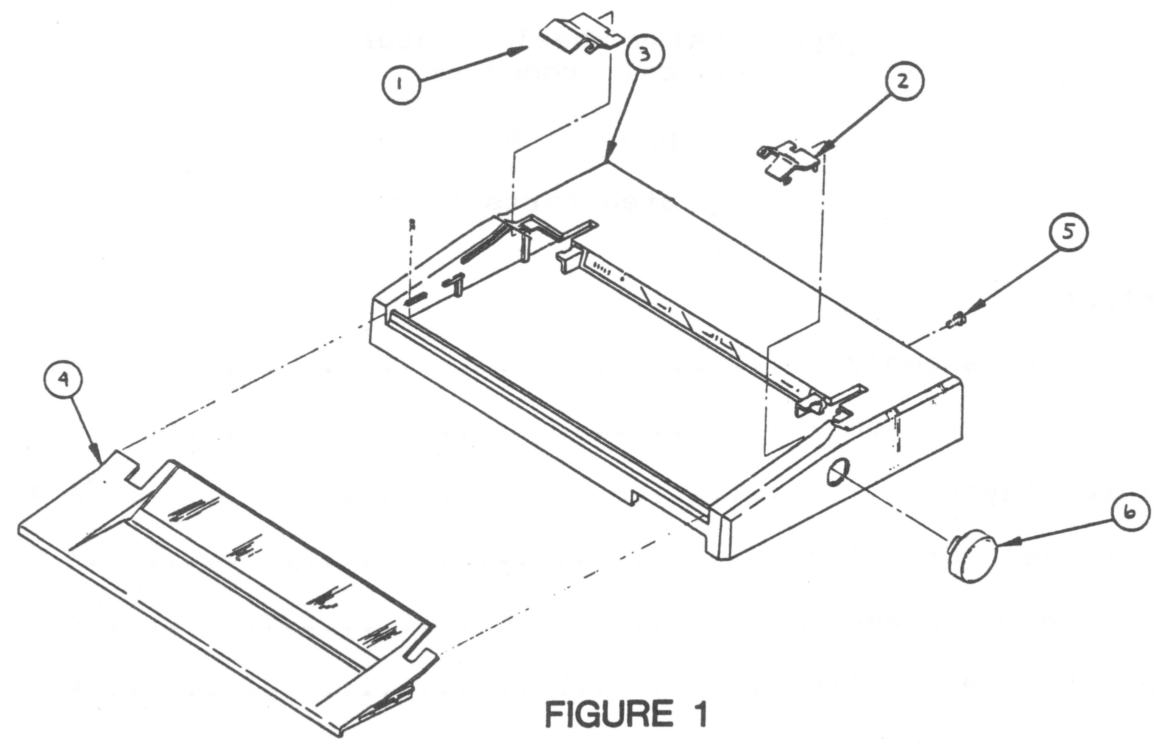


FIGURE 1

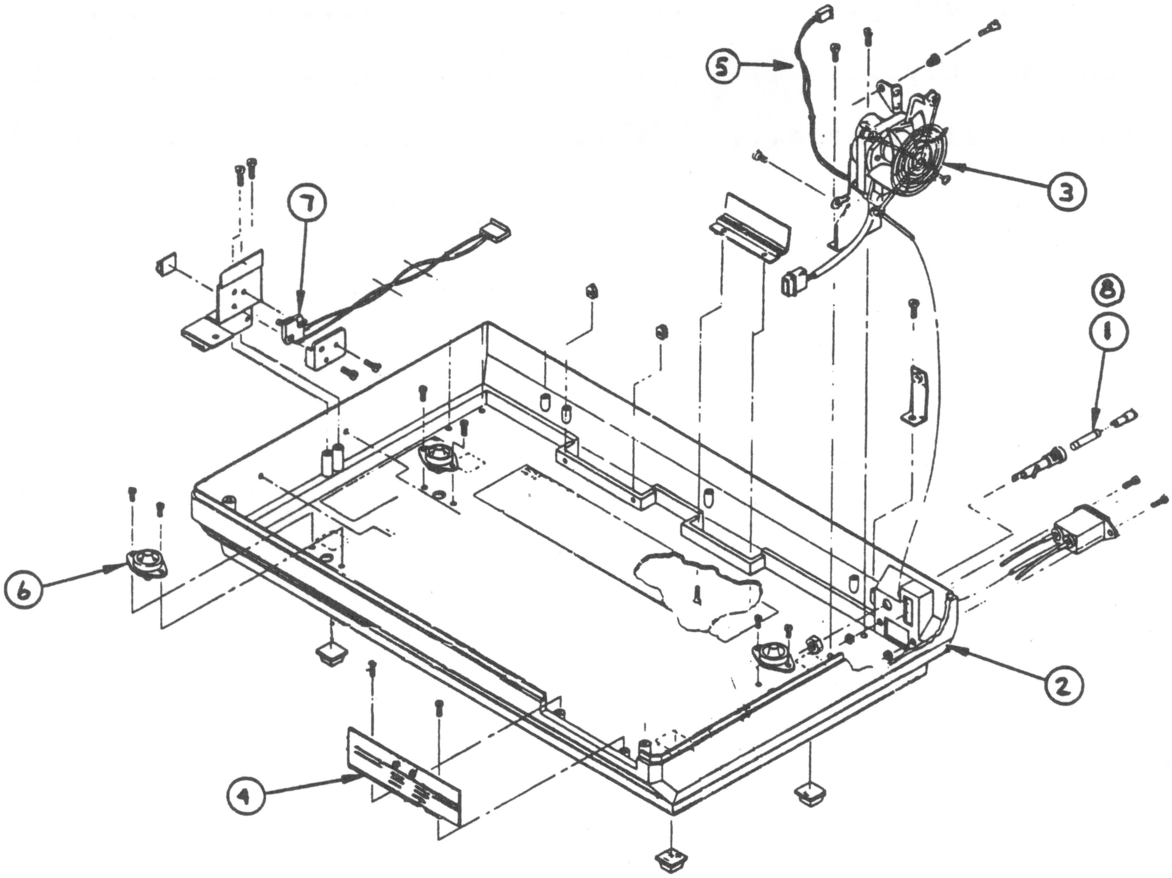


FIGURE 2

The figures and lists below include all piece parts that can be purchased separately from Apple for the Apple Daisy Wheel Printer, along with their part numbers. Contact your local Apple Level Two Service Center for prices.

TOP COVER ASSEMBLY

Figure 1 Item #	Part #	Description
1	970-0044	Door, Tractor Cover Left
2	970-0045	Door, Tractor Cover Right
3	970-0043	Cover, Top
4	699-0106	Panel Assembly, Access
5	970-0624	Screw, Plastic (covers)
6	970-0002	Knob, Platen

BOTTOM COVER ASSEMBLY

Figure 2 Item #	Part #	Description
1	740-0103	Fuse, 5 Amp 3AG (110V)
2	970-0042	Cover, Bottom
3	970-0038	Fan Assembly, Mini-Intake
4	970-0580	P. C. B., Front Panel Indicator
5	699-0102	Resistor Assembly, Hammer
6	970-0036	Shock Mount
7	970-0037	Switch, Cover Interlock
8	740-0102	Fuse, 3 Amp 3AG (220V) (for European DWP)

PRINTER LAYOUT

Figure 3 Item #	Part #	Description
1	970-0581	Cable Assembly, Front Panel
2	970-0582	DIP Switch, Rocker Type
3	970-0618	Fastener, Grommet (PCB)
4	970-0619	Fastener, Plunger (PCB)
5	661-75087	PCB, Main Logic Card

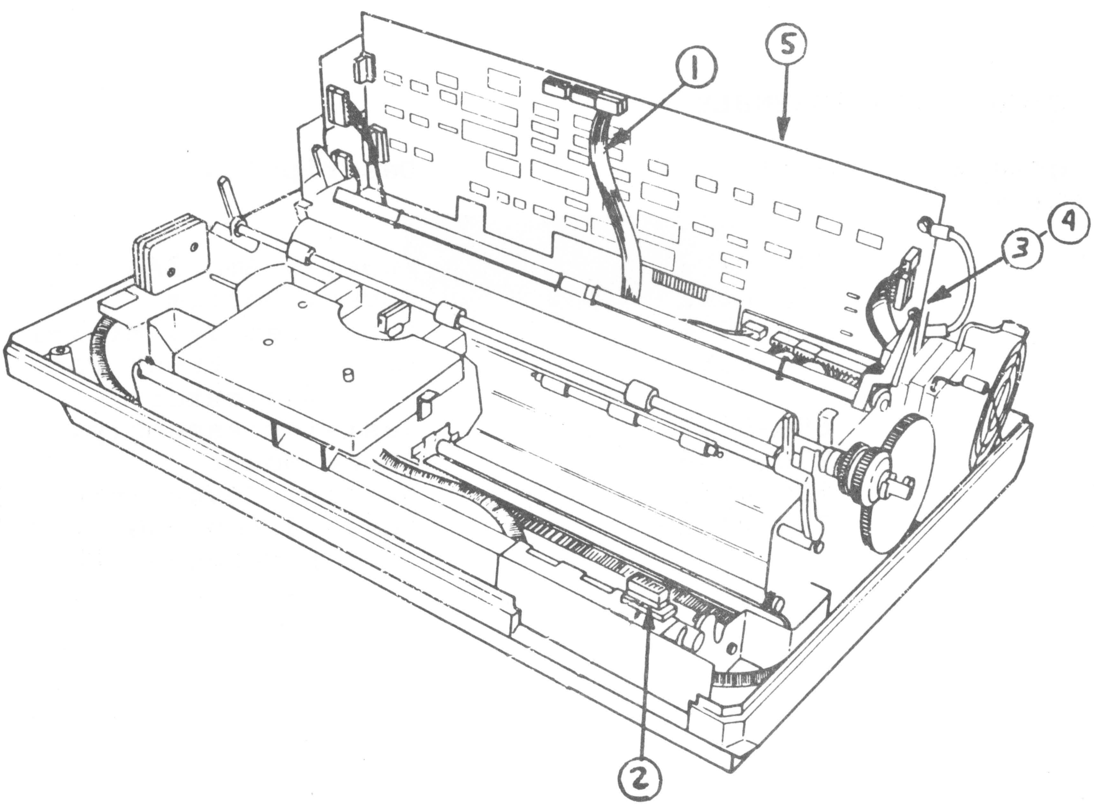


FIGURE 3

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PRINTWHEEL MOTOR ASSEMBLY

Figure 4 Item #	Part #	Description
1	970-0003	Hammer Assembly complete
2	970-0013	Bumper, Hammer Armature
3	970-0018	Spring, Extension (P.W. mtr. latch)
4	699-0099	Armature, Hammer Assembly
5	970-0022	Latch, P.W. Motor
6	970-0613	Nut Plate, Hammer
7	970-0623	Screw 3-48 X .625

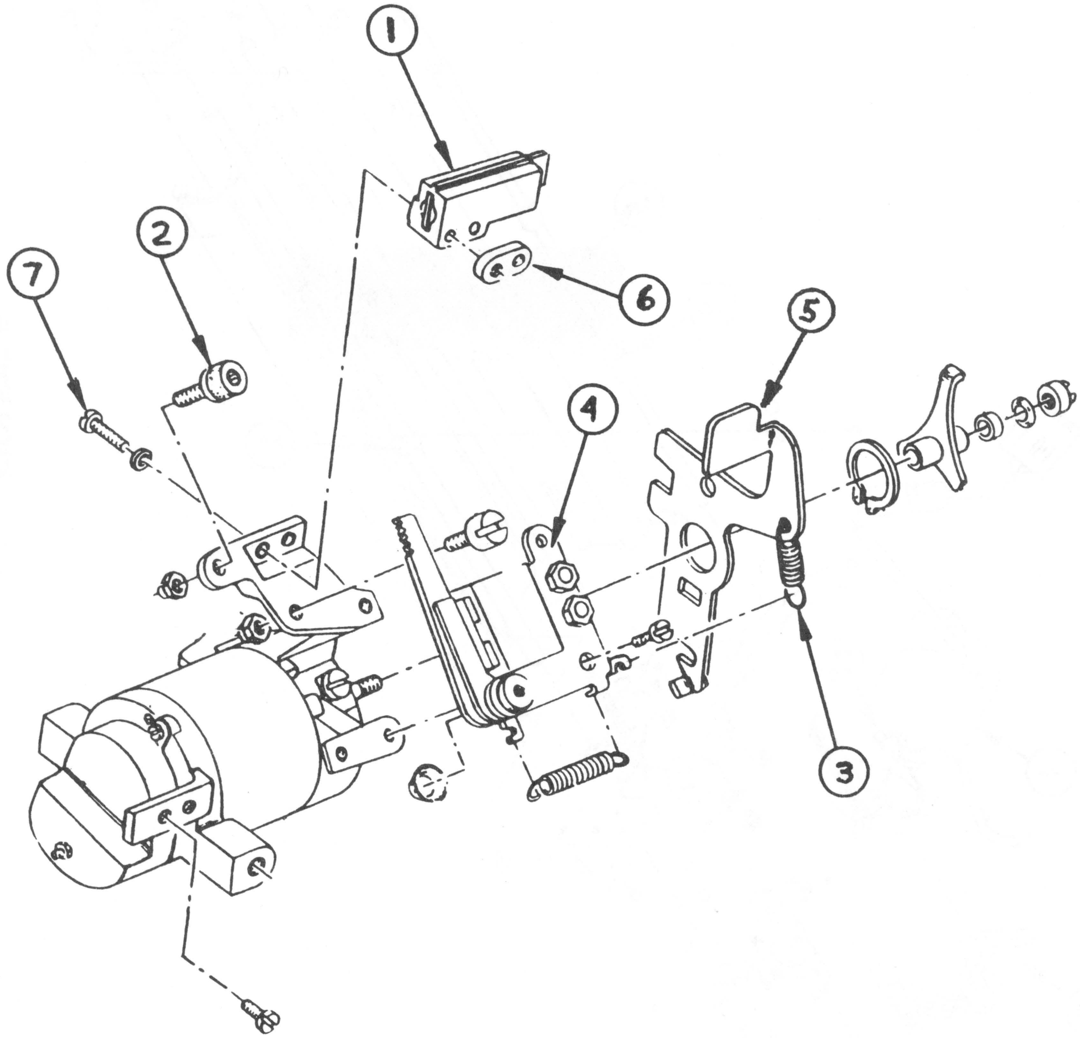


FIGURE 4

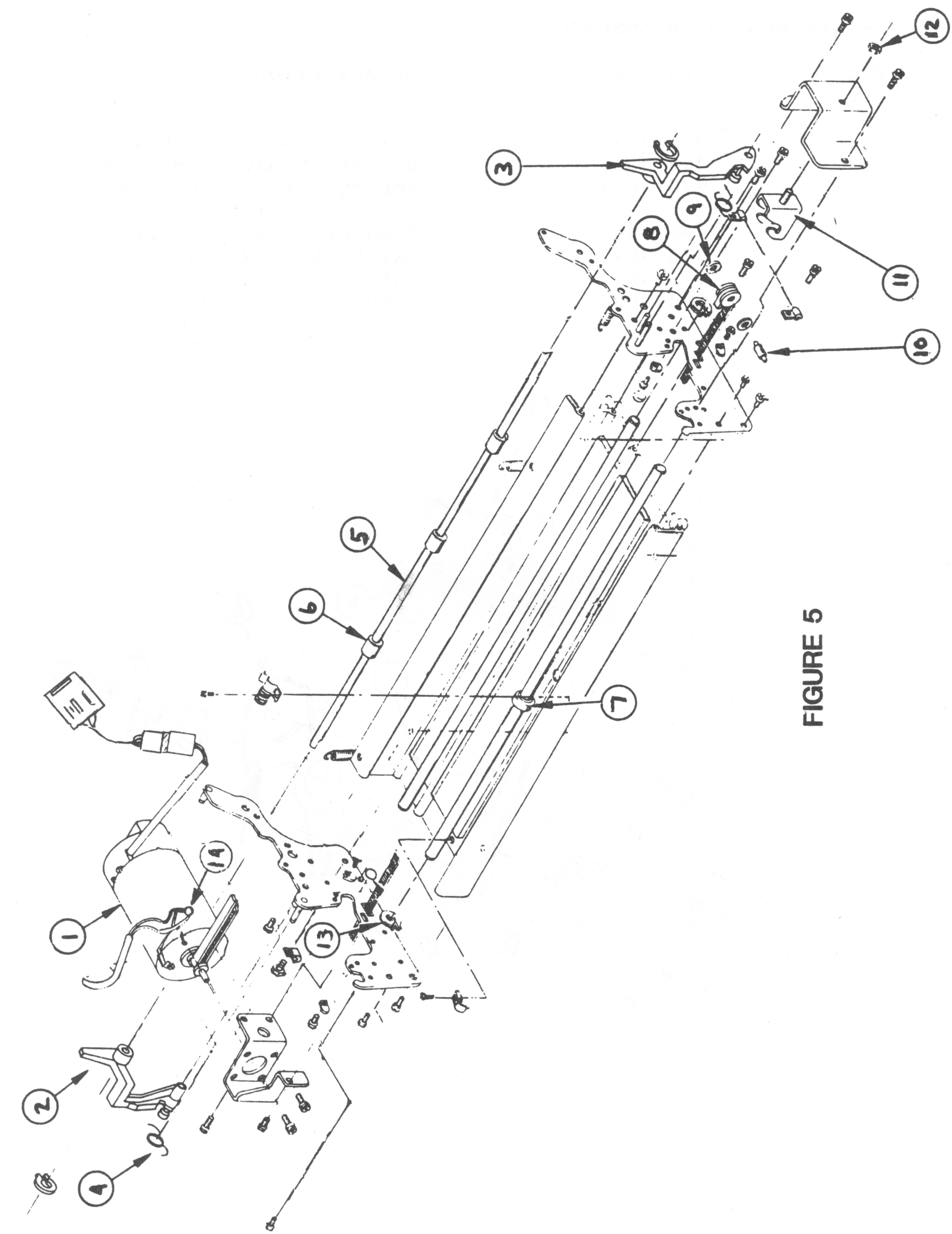


FIGURE 5

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CARRIAGE DRIVE MECHANISM

Figure 5 Item #	Part #	Description
1	661-75090	Motor, Carriage Drive complete
2	970-0040	Lever, Paper Bail Left
3	970-0041	Lever, Paper Bail Right
4	970-0622	Spring, Extension (paper bail)
5	970-0031	Shaft, Paper Bail
6	970-0019	Roller, Paper Bail (rubber)
7	970-0030	Bearing, Spherical
8	970-0005	Pulley, Idler Assembly
9	970-0029	Washer, Thrust
10	970-0028	Shaft, Pulley Assembly
11	970-0027	Bracket, Pulley Adjust
12	970-0085	Nut, #8 Hex Lock
13	970-0607	Grip Ring
14	970-0621	Capacitor, Carriage Motor

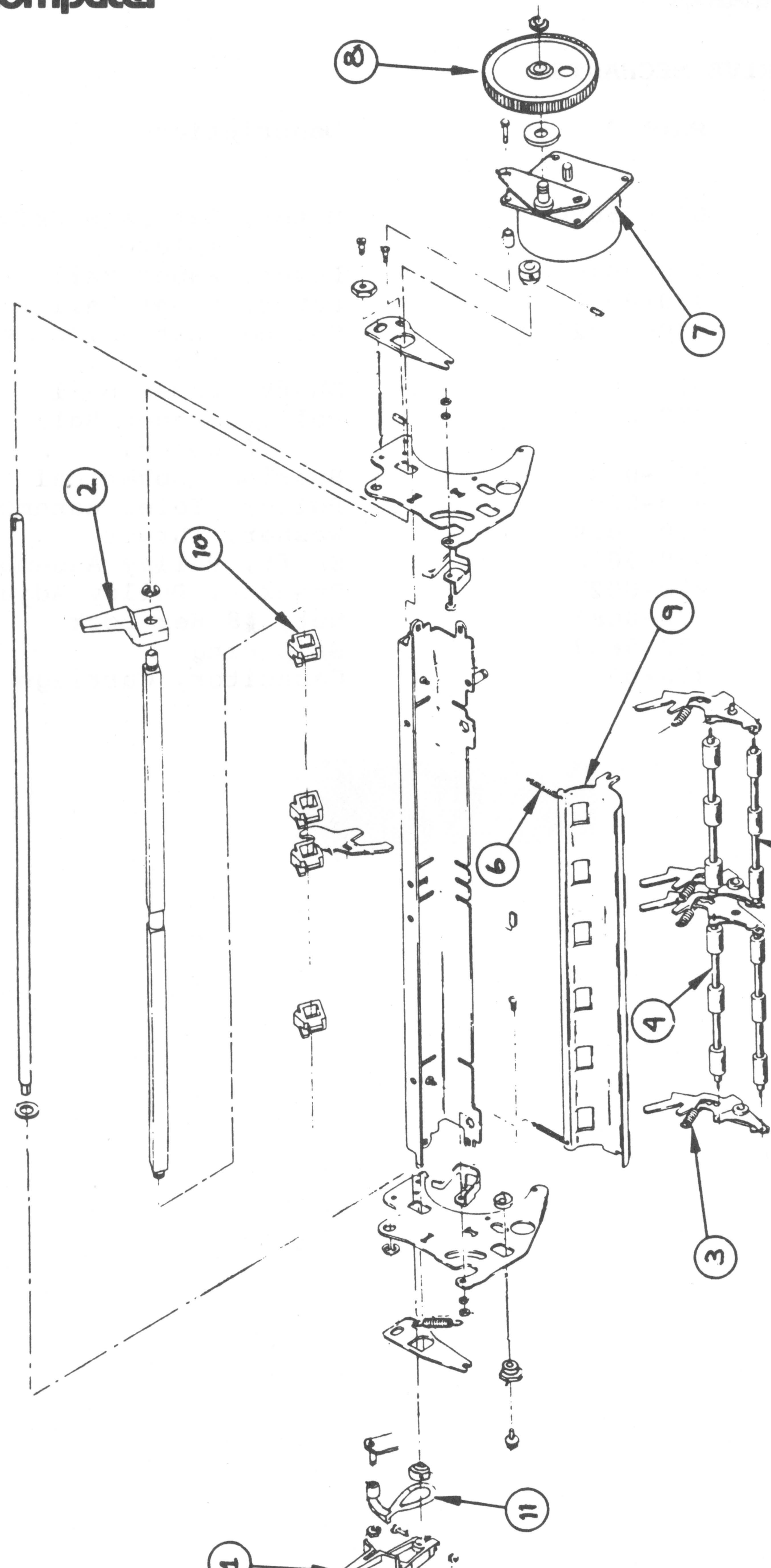


FIGURE 6

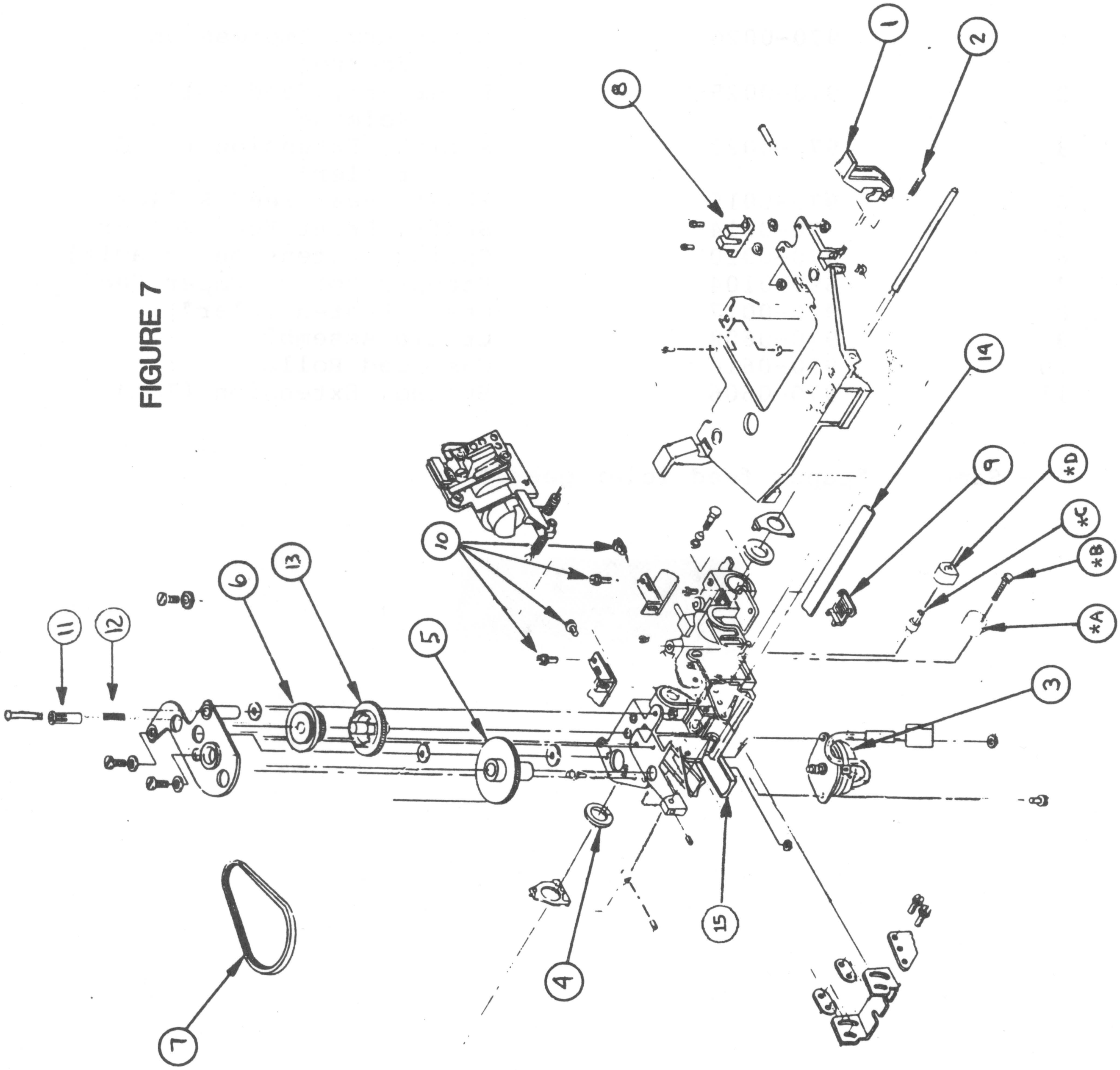
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PAPER FEED MECHANISM

Figure 6 Item #	Part #	Description
1	970-0026	Lever Arm, Impression Control
2	970-0025	Lever Arm, Feed Roller Release
3	970-0023	Spring, Extension (feed roller)
4	970-0015	Shaft, Rear Feed Roller
5	970-0014	Shaft, Front Feed Roller
6	970-0020	Spring, Extension (cradle)
7	699-0104	Stepper Motor, Paper Feed
8	970-0017	Gear, Platen Idler*
9	970-0608	Cradle Assembly
10	970-0610	Cam Feed Roller
11	970-0606	Spring, Extension (ICL)

* - Same as "paper feed idler gear."

FIGURE 7



apple computer

CARRIAGE ASSEMBLY 661-75089 Carriage Assembly (complete)

Figure 7 Item #	Part #	Description
1	970-0032	Latch, Ribbon Box
2	970-0024	Spring, Extension (ribbon latch)
3	970-0034	Stepper Motor, Ribbon Feed
4	970-0004	Felt Wiper, Carriage
5	970-0033	Pulley Assembly, Ribbon Rewind
6	970-0076	Drive Gear, Ribbon Clutch
7	970-0079	Drive Belt, Ribbon Rewind
8	970-0021	Photon Module (EOR)
9	970-0612	Cleat, Belt
10	970-0614	Screw 4-40 X 5/16 SEMS
11	970-0615	Drive Key, Ribbon Drive
12	970-0616	Spring, Compression (Ribbon Dr Key)
13	970-0617	Pulley, Timing (Ribbon)
14	970-0001	Drive Belt, Timing
15	970-0722	Yoke, Bearing
*A		Eccentric lobe
*B		Eccentric screw
*C		Eccentric washer
*D		Plate, Ribbon Plate Lock

* These parts are now obsolete. If one of them requires replacement, replace all four with the following new parts:

A	970-0626	Bracket, Ribbon Plate Adjust (1ea.); replaces eccentric lobe
B	970-0625	Screw 6-32 X .562 (2ea.); replaces eccentric screw
C	970-0628	Washer #6 (2ea.); replaces eccentric washer
D	970-0627	Plate, Ribbon Plate Lock (1ea.); replaces eccentric lobe

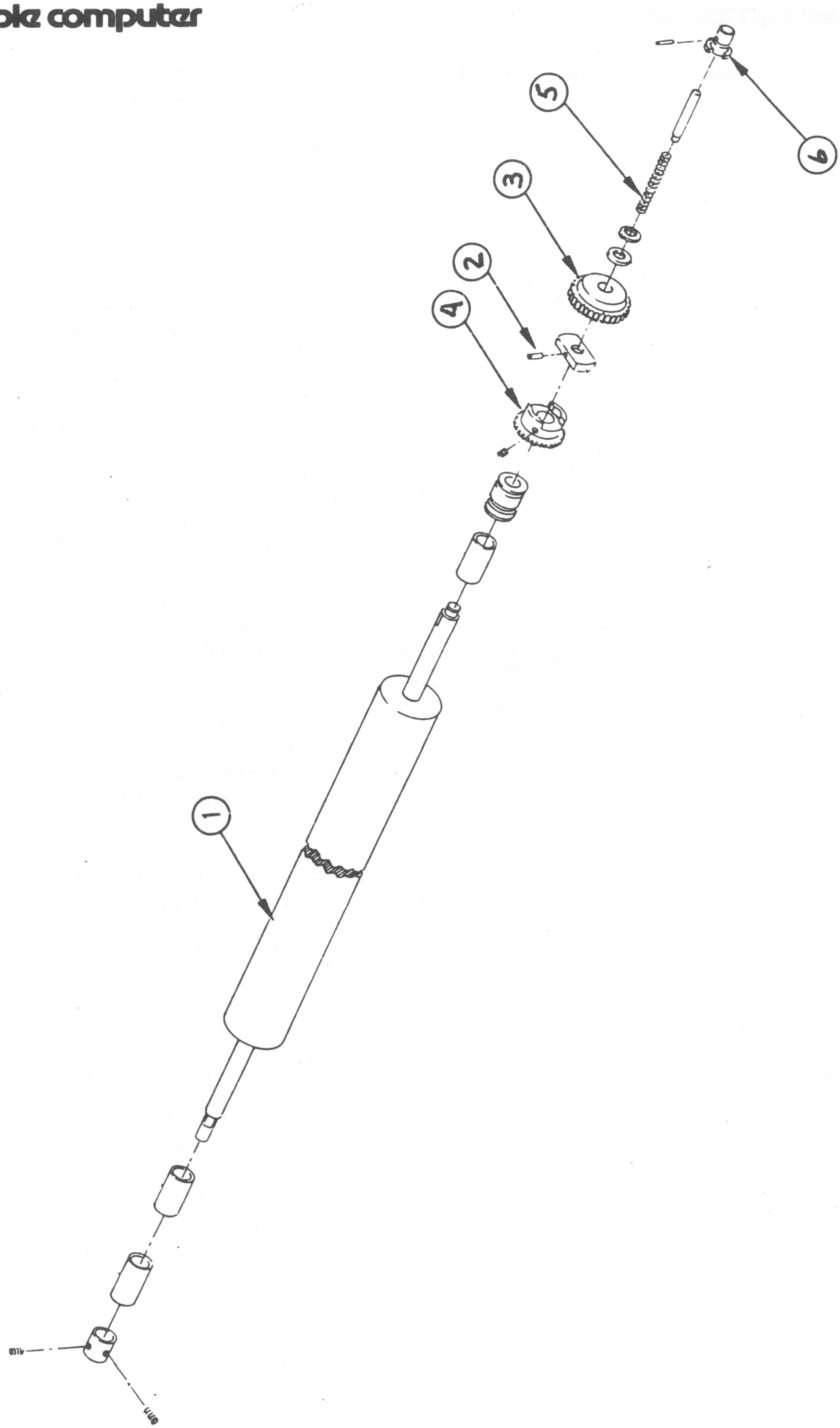


FIGURE 8

PLATEN ASSEMBLY **699-0101** **Platen Assembly complete**

Figure 8 Item #	Part #	Description
1	699-0098	Core, Platen
2	970-0035	Needle Roll
3	970-0016	Gear, Platen
4	970-0602	Gear, Tractor Drive
5	970-0603	Spring, Compression
6	970-0604	Adapter, Platen Knob

PARTS NOT ILLUSTRATED

Part #	Description
699-0103	Shield Assembly, Ribbon
970-0010	Switch, AC Line
661-75088	PCB, Power Supply, 115 Volt
661-75101	PCB, Power Supply, 220 Volt
740-0030	Fuse, Pico 2 Amp
740-0031	Fuse, Pico 4 Amp
740-0032	Fuse, Pico 5 Amp

Scribe

APPLE SCRIBE PRINTER TECHNICAL PROCEDURES

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Section 1 - Basics

Section 2 - Take-Apart

Section 3 - Adjustments

CONTINUED ON NEXT PAGE

Section 4 - Troubleshooting

Section 5 - Preventive Maintenance

Section 6 - Illustrated Parts

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Scribe Printer Technical Procedures

Section 1

Basics

Contents:

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WHAT'S IN THIS SECTION

This section, Basics, gives you information about paper requirements, DIP switch settings, self-tests, and connector functions that can help you in troubleshooting and general use of the Apple® Scribe® Printer.

CONFIGURATION REQUIREMENTS

The Scribe printer uses the same interface cable as the Apple ImageWriter Printer.

In general, software drivers and filters for the ImageWriter will work for the Scribe, but certain features (such as boldface) will not be supported. Some software programs, such as AppleWorks™, require a customized driver program for the Scribe printer. (For more information, refer to the "Printers and Printing" chapter in the AppleWorks manual.) Customized print drivers for the Scribe will also offer optimized ribbon use in certain applications.

DIP SWITCH SETTINGS

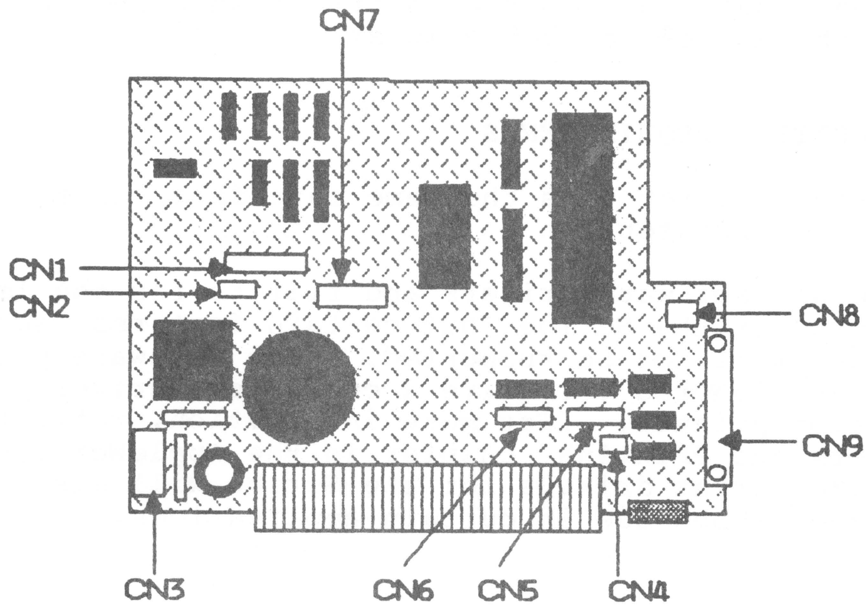
The DIP switches are located on the back side of the printer, near the serial interface connector, concealed under a removable cover. The switch cover can be pried off with a small flatblade screwdriver, and the eight numbered switches can be pushed up or down by hand or with a small screwdriver. On the Self Test or Loopback Test, the DIP switch settings are printed out as 1's or 0's in reverse order (87654321), as shown here:

```
DIPSW(00*00000),'1=ON,0=OFF'
```

A 0 indicates that the switch is in UP position (= OFF), a 1 indicates DOWN position (= ON). Switch 6 is always shown as an asterisk (*) rather than a 1 or 0, because it is an electrical switch rather than a firmware control. This does not mean that switch 6 is not functional: together with switch 5, it controls print intensity (see **Paper Requirements**, below).

A complete table of DIP switch functions and settings is found in the Scribe User's Manual, Part II: Reference, Appendix B.

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Main Logic Board
Connector Functions

CN1 - Out-of-Ribbon Sensor,
Print Head Solenoid

CN2 - Out-of-Paper Sensor

CN3 - Connects to transformer, power supply.

CN4 - Carriage Motor resistor

CN5 - Paper Feed Motor

CN6 - Carriage Motor

CN7 - Control Panel Lights and Switches,
Cover Interlock Switch

CN8 - Left Margin (Home Position) Switch

CN9 - Connector to Host Computer (I/O)

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PAPER REQUIREMENTS

The Scribe printer is a **thermal transfer printer:** a heated print head, applied to a special ribbon, transfers the ink from the ribbon onto ordinary (non-thermal) paper. Alternatively, the Scribe can be used with thermal paper, with or without a ribbon. Using a ribbon along with thermal paper results in a very sharp black image.

The Scribe works best with smooth paper, 16- to 24-pound weight, such as that used for copying machines. Ordinary pin-feed paper is satisfactory, but coarser grades may cause light and uneven print quality. Print intensity can be adjusted using DIP switches 5 and 6 as follows.

	Switch	Position
For normal density:	5	Up
	6	Up
For low density:	5	Up
	6	Down

The Scribe can also be used effectively with transparencies. When printing on transparencies, use the following settings:

	Switch	Position
For normal density:	5	Down
	6	Up
For low density:	5	Down
	6	Down

In general, the Scribe works best with smooth bond paper. If a customer complains of print quality problems, the paper being used should be examined first. Always use the optimum bond paper when running tests.

MAIN LOGIC BOARD CONNECTOR FUNCTIONS

The diagram on the opposite page shows the functions controlled through the different cables connected to the Main Logic Board.

PRINTER SELF-TEST AND LOOPBACK TEST

As a general check of the Scribe printer, a level 1 technician should run the Loopback Test in preference to the Printer Self-test, because it includes a check of the data-sending and -receiving lines and circuits.

Printer Self-Test

The Printer Self-test allows the user to verify that the printer is operational. It prints out the ROM revision and DIP switch settings, and produces a print sample that can be used for print quality checks.

To run the Printer Self-test,

1. Make sure paper, ribbon, and top cover are installed.

2. Hold down the **line/form feed** button while turning the power on with the **power** button.

Loopback Test

The loopback test is identical to the self-test except that it also checks ROM, RAM, and data-sending and -receiving functions. Whenever you check a printer, run the loopback test to check operation and communications ability. (**NOTE:** The Loopback Test does not test the "handshaking" ability or setting (DTR or XON/XOFF) of the Scribe; the printer could pass the loopback test and still have faulty handshake circuits.)

To run the loopback test,

1. Make sure paper, ribbon, and top cover are installed.

2. Connect a loopback connector (a standard DB-25 connector with pins 2 and 3 jumpered) to the serial port on the printer.

3. Hold down the **letter** button while turning the power on with the **power** button.

If the printer passes the test, the words "LOOPBACK TEST" will be printed, followed by the ROM revision number, DIP switch settings, and character set printout.

If the printer fails the test, no printing will occur; the **select** lamp will flash either a RAM check or Loopback error pattern (see Section 4, **Troubleshooting**, for error lamp display patterns). This will also happen if you try to run the test without a loopback connector installed.

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Disabling the Cover Interlock Switch

Like most printers, the Scribe contains a **cover interlock switch** that prevents it from functioning when the cover is removed. When you remove the printer cover (see Section 2, **Take Apart**), you will see the switch to the left of the **select** and **letter** switches. To run the Self-test or Loopback Test with the cover off, you can defeat the switch by wedging a piece of rolled-up paper or a similar non-metallic object in the switch opening.

Scribe Printer Technical Procedures

Section 2

Take-Apart

Contents:

IMPORTANT: There are two existing control panels for Scribe:

1. On the **original one-piece control panel,** the logic board cable is soldered to the panel, shielded with copper to pass RFI tests, and threaded through guides along the inside perimeter of the cover.

2. On the **newer two-piece control panel** there are two separate parts:

   a. The control panel itself (connected to the cover), which has a short cable and connector soldered to it.

   b. The logic board cable, which is mounted to the front of the mechanism assembly and runs underneath it to the logic board. When you exchange a mechanism assembly, this cable must be returned with the mechanism assembly module.

The take-apart procedures which follow are based on the original one-piece control panel configuration. For additional procedures specific to the newer two-piece control panel, see **Control Panel Upgrade** in this section.

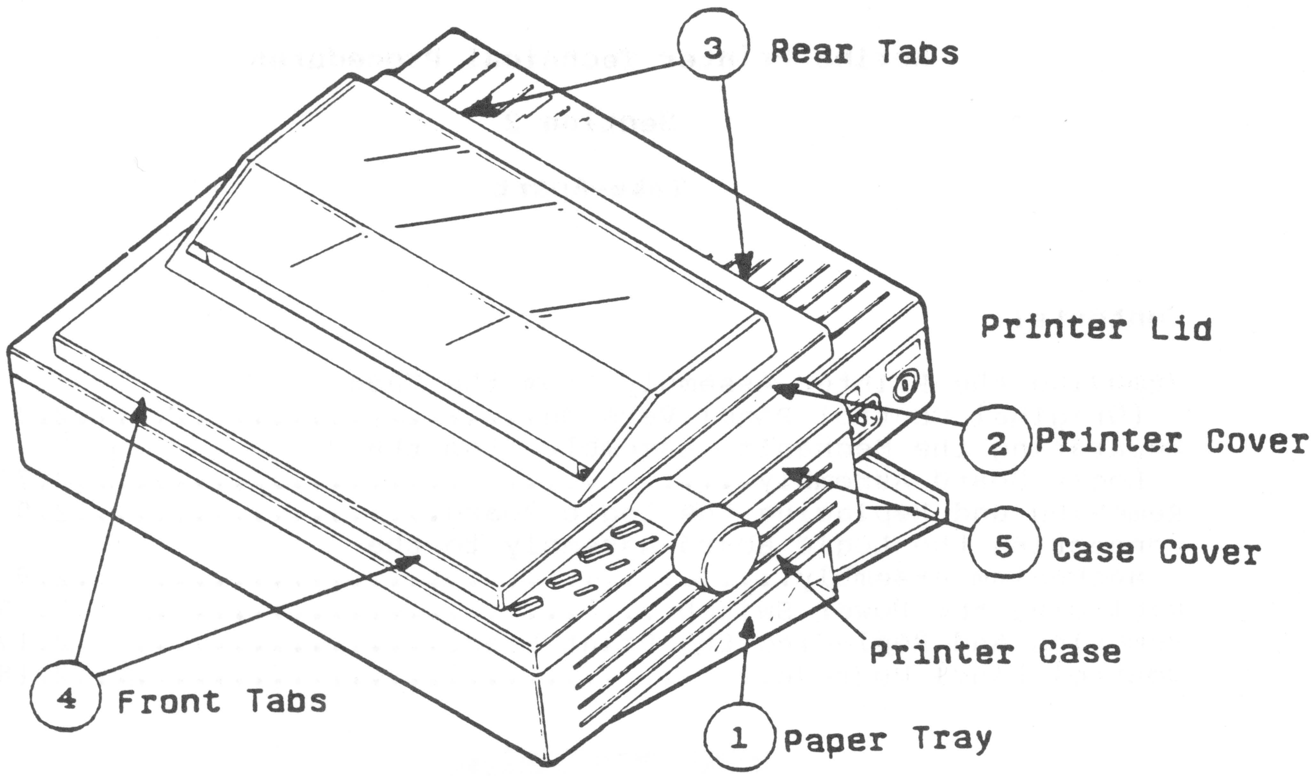


Figure 1

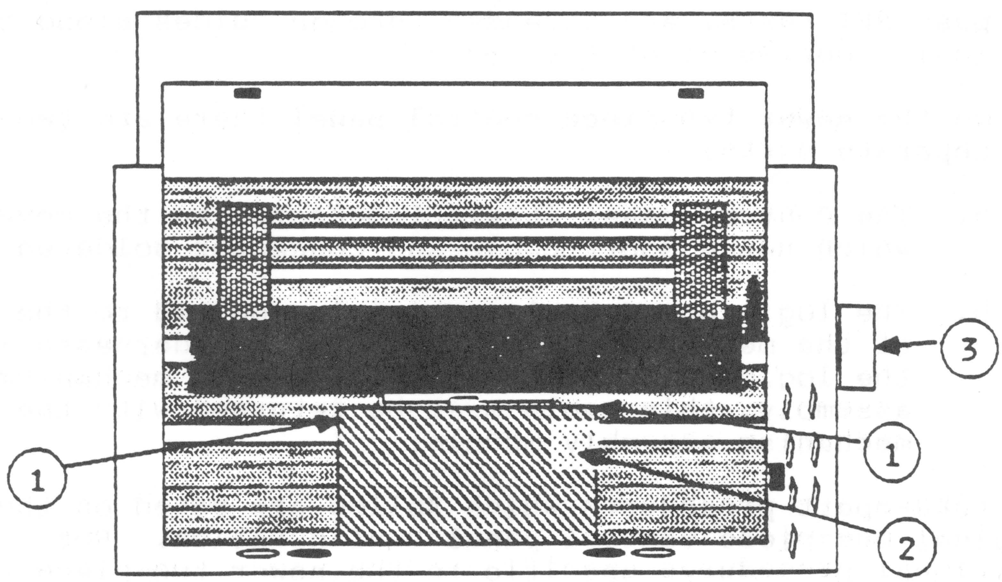


Figure 2

REMOVING THE PRINTER ASSEMBLY FROM THE CASE

Required Tools: medium Phillips screwdriver (magnetized)
small flatblade screwdriver
needlenose pliers
magnetic pick-up device or tweezers
foam workpad or equivalent
IC extractor (Apple P/N 918-0017)

Before you can perform any repairs or adjustments on the Scribe, remove the printer assembly from the case according to the following instructions. **NOTE:** In all instructions that refer to "left" and "right," we assume that you are facing the front of the Scribe, where the Apple logo appears.

1. Turn off the power switch and remove the AC power cord from the Scribe.

2. Remove any paper from the printer, and lift the printer off the paper tray (Figure 1, #1) (if present).

3. Remove the translucent printer cover (Figure 1, #2) as follows:

   a) Press forward on the back panel of the printer cover and lift it to free the two tabs in back (see Figure 1, #3).

   b) Pull the cover slightly toward the back and up (to free the tabs in front - see Figure 1, #4).

4. Remove the ribbon cassette as follows:

   a) Place your index fingers under the ribbon cassette, with one finger on each side, close to the platen (see Figure 2, #1).

   > **CAUTION:** The ribbon sensor is hidden under the cassette (see Figure 2, #2). Be sure that the finger on the right is under the **cassette** and not under the **ribbon sensor.**

   b) Lift up with your fingers until the cassette pops out. Then remove it from the printer.

5. Pull the platen knob (Figure 2, #3) off the platen shaft.

6. Remove the case cover (Figure 1, #5) as follows:

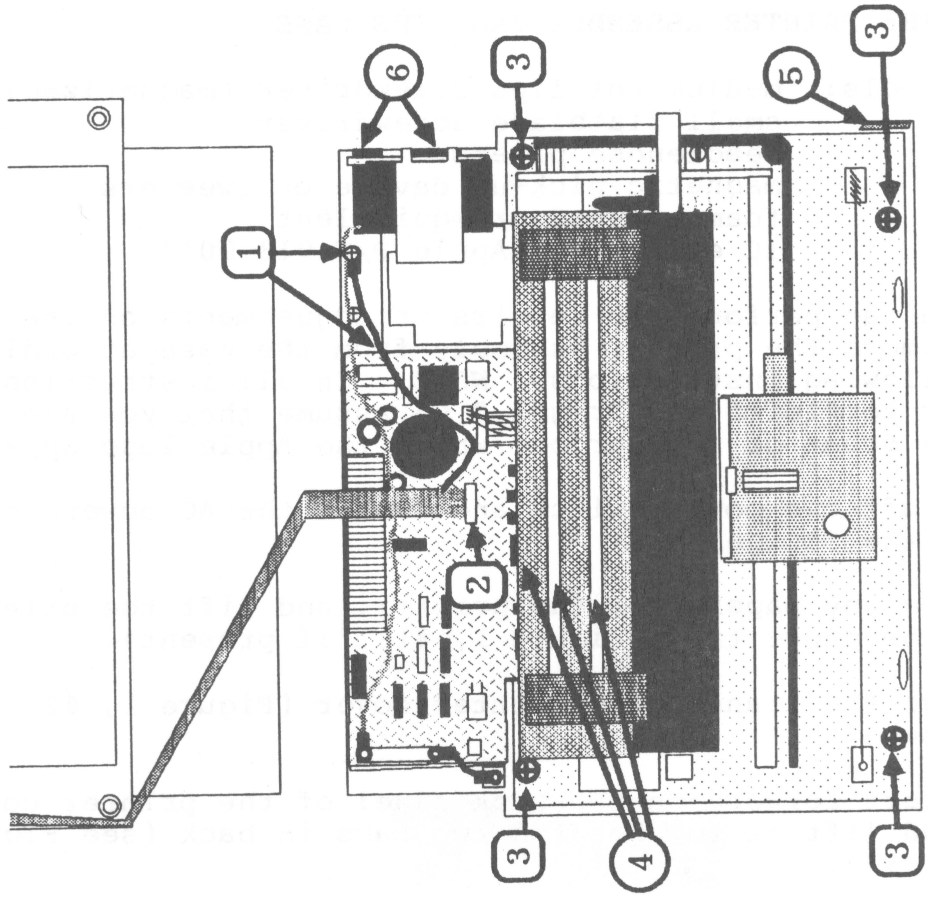


Figure 4

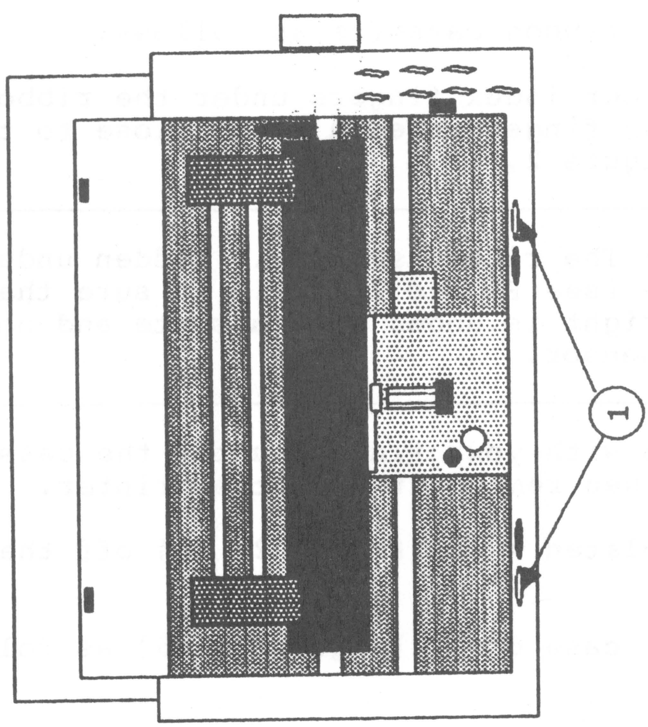


Figure 3

a) Turn the Scribe over onto the workpad and remove the two screws on the bottom of the case.

b) Hold the case together and turn it right side up.

c) Free the ground wire from the right front corner of the baseplate by pushing on its connector with a screwdriver or needlenose pliers.

d) Locate the two tabs inside the front of the case (see Figure 3, #1). Notice the slots above the tabs on the inside of the front cover. To free the cover, push forward through the left slot with a small screwdriver while lifting up on the left corner of the printer cover. Repeat for the right tab.

e) Lift the front of the case cover up, pull the cover off its rear tabs, and lay it upside down behind the case; DON'T STRAIN THE RIBBON CABLE that connects the cover to the case.

f) Locate the ground wire that connects the ribbon cable to the rear of the chassis (Figure 4, #1). Free it from the chassis by removing the screw. **IMPORTANT:** Keep this screw with the ground wire. It is longer than the other chassis screws.

g) Disconnect the ribbon cable from the logic board **by pulling on the connector, not on the cable.** (See Figure 4, #2.)

h) Set the case cover aside.

7. Remove the four baseplate screws (Figure 4, #3).

8. Remove the printer assembly from the case as follows:

a) Push the little grey cable-clamp out of the way (Figure 4, #5).

b) Grasp the assembly by the two metal rods and the back plate (Figure 4, #4) and lift it up, right side first, out of the case. (You may have to free the AC fuse holder and the power cord socket (Figure 4, #6) by prying outward on the case with a screwdriver or fingers as you begin lifting.)

c) Place the printer assembly on a stable work surface and set the case aside.

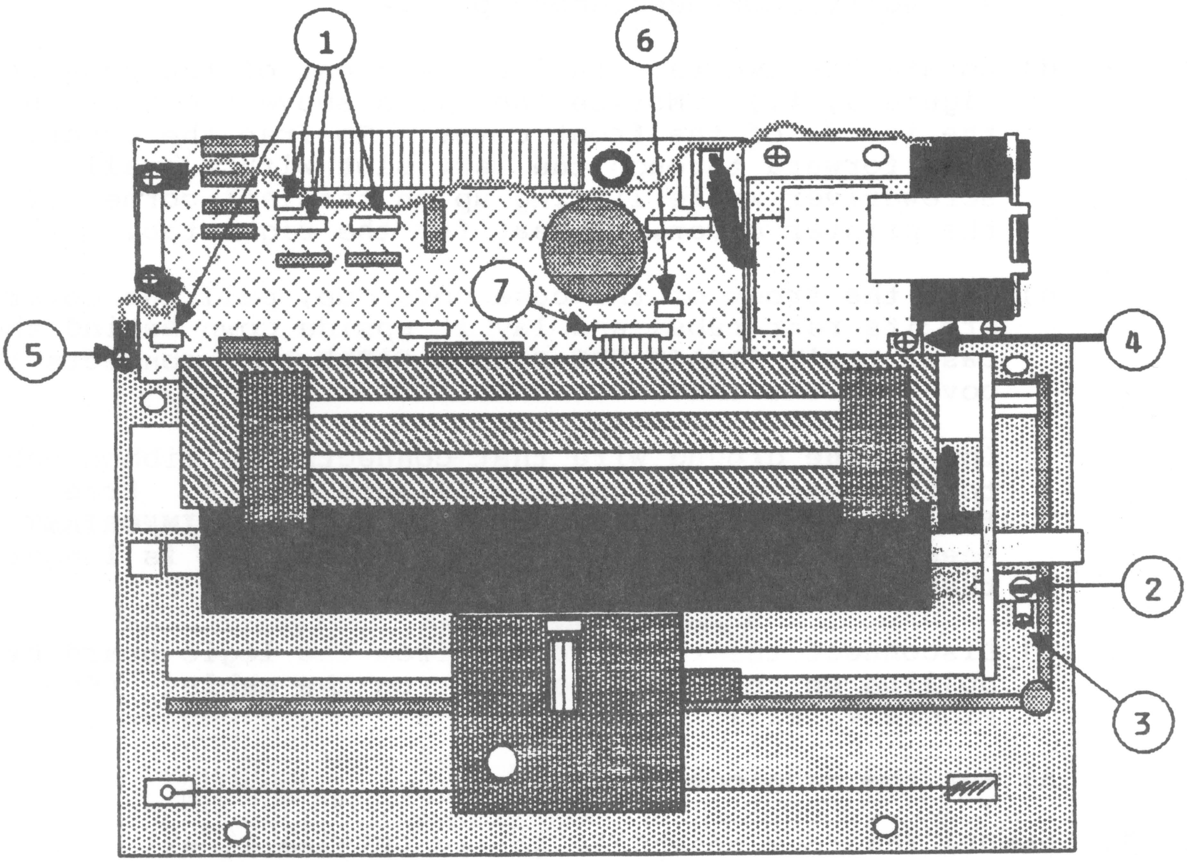


Figure 5

SEPARATING THE MECHANISM ASSEMBLY FROM THE LOGIC BOARD ASSEMBLY

1. Disconnect the cables from the four leftmost sockets on the logic board (Figure 5, #1). Remember to pull on the cable connectors, not on the wires.

2. Remove the power switch (Figure 5, #2) from the right side of the mechanism assembly as follows:

   a) Remove the screw at the base of the power switch (Figure 5, #3).

   b) If you push the switch to the right, you will notice that it is held to the mechanism by a twisted metal tab. Use needlenose pliers to straighten the tab, and then push the switch free.

   c) Carefully disengage the switch wires from their three plastic clamps and rest the switch near the logic board. DO NOT STRAIN THE SWITCH WIRES.

3. Remove the screw just to the right of the transformer (Figure 5, #4).

4. Remove the small screw at the far left that connects the mechanism assembly to the electrical assembly (Figure 5, #5).

5. Separate the two assemblies slightly by sliding the logic board away from the mechanism assembly, about one inch. Don't strain the cables that still connect the two assemblies.

6. Disconnect the cable next to the flat mylar cable (Figure 5, #6).

7. Disconnect the flat mylar print head cable (Figure 5, #7) from the logic board as follows:

   a) Using the IC extractor, pull up the ceramic cable-holder about 1/8 inch (Figure 5, #7) to release the cable. DO NOT FORCE IT; DO <u>NOT</u> PULL THE CONNECTOR <u>OFF</u>. Be careful not to damage the mylar cable.

   b) Pull the mylar cable out of the cable-holder. IT SHOULD SLIDE OUT EASILY: if it resists, pull the cable-holder up further. DO NOT FORCE THE CABLE.

8. Slide the assemblies apart.

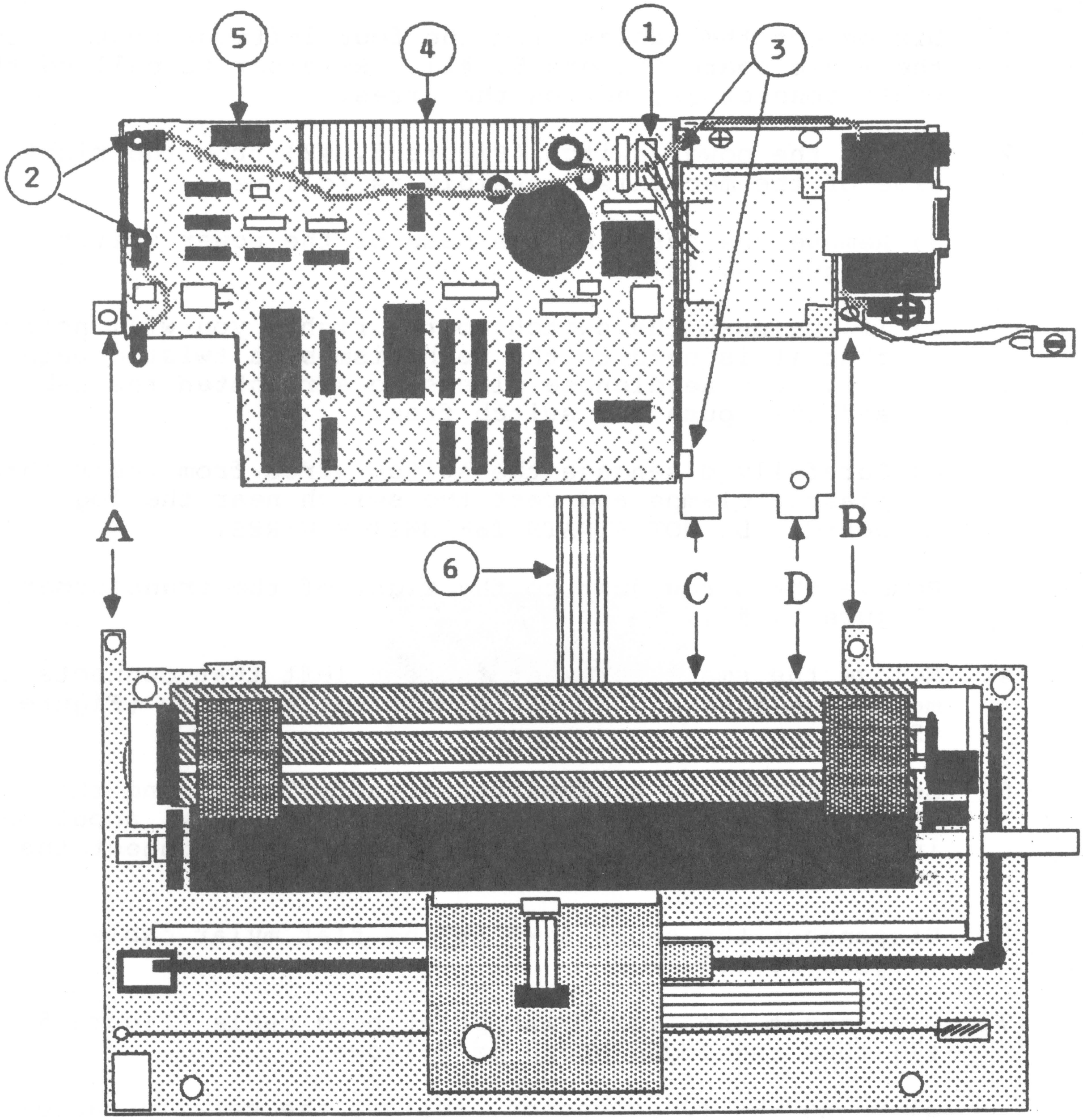


Figure 6

REMOVING AND REPLACING THE LOGIC BOARD

Remove

1. Disconnect the four-wire transformer plug from the logic board (Figure 6, #1).

2. Remove the two screws from the DB25 connector (Figure 6, #2) and set the ground wires aside.

3. Slide the logic board out from the small plastic clamps that hold it (Figure 6, #3), and set it aside.

Replace

1. Slide the new logic board into the plastic clamps.

2. Line up the holes at the sides of the DB-25 connector with the screw holes in the baseplate.

3. Insert and fasten the DB-25 connector's screws with the ground wires under them, as follows:

   a) The long ground wire from the right goes to the rear of the DB-25; route it in front of the heat sink (Figure 6, #4) and the DIP switches (Figure 6, #5).

   b) The short ground wire (which you removed) goes to the front of the DB-25.

4. Connect the four-wire transformer plug to its socket (Figure 6, #1).

CONNECTING THE LOGIC BOARD ASSEMBLY TO THE MECHANISM ASSEMBLY

1. Lay the Logic Board Assembly behind the Mechanism Assembly on a flat surface. (See Figure 6.)

2. Move all cables out of the way, so that none will be pinched or hidden when you push the assemblies together.

3. Make sure the mylar cable (Figure 6, #6) is lying on top of the logic board.

4. Slide the two assemblies together, making sure that Tabs A and B of the logic board lie <u>under</u> Tabs A and B of the mechanism assembly (see Figure 6).

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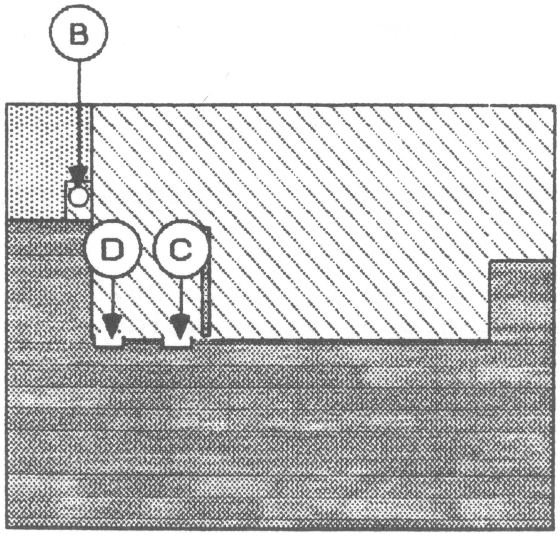


Figure 7

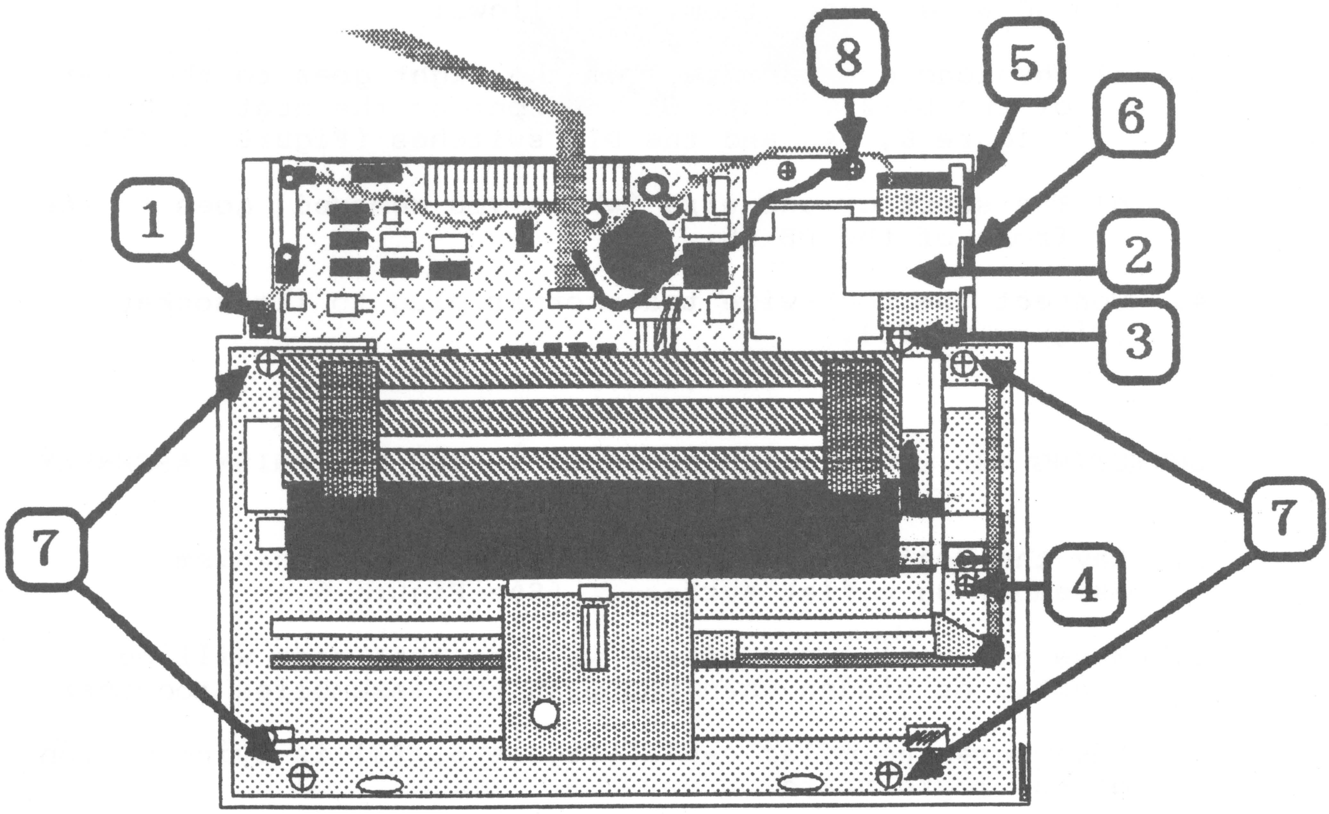


Figure 8

5. **IMPORTANT:** Lift up the two assemblies to make sure that tabs C and D on the logic assembly baseplate fit fully into slots C and D on the mechanism assembly baseplate (see Figure 7), and that tab B is correctly seated over its threaded hole. If the tabs are not correctly seated, repeat step 4.

6. Insert and tighten the small screw at the far left, with the short ground wire under it (Figure 8, #1).

7. Insert and tighten the screw next to the transformer (Figure 8, #3). You may have to move the noise filter and wires out of the way (Figure 8, #2 -- nothing is holding them down except friction).

8. Reconnect the mylar cable as follows:

   a) Lift the ceramic cable-holder to full upward position (use fingers or IC extractor).

   b) Hold the mylar cable as close to its end as possible, and insert it as far as it will go into the ceramic cable-holder.

   c) Push down the ceramic cable-holder to lock the cable in position.

   d) Gently tug on the mylar cable to test that it is held firm. If it moves, repeat steps a through c and test again.

9. Reconnect the five other cables (all except the ribbon cable) to the logic board. They are keyed by size and color so that you can see where they go.

10. Put the power switch back into place, reroute its wires under their three clamps, insert its tab into the proper slot, and refasten its screw (a small one) (see Figure 8, #4).

11. Retwist the tab on the power switch just enough to hold it.

12. Holding the printer assembly by the metal bars, lower it into the case, left side first, so that the DB25 connector slides into its slot first. (You may have to bend the front tabs out of the way to do this).

13. Make sure the AC fuse holder and the AC power cord socket (Figure 8, #5 and #6) fit into their slots in the case. If they don't, push them gently into place.

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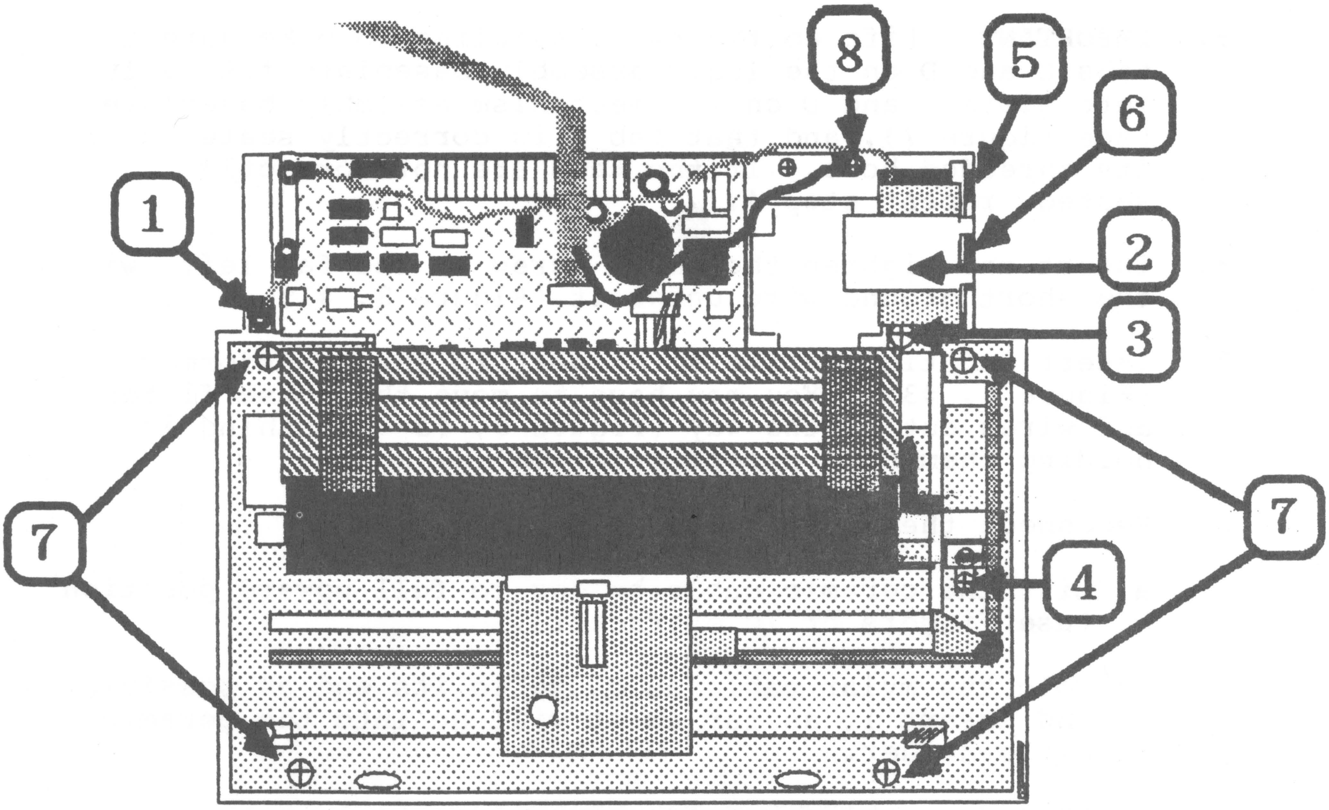


Figure 8

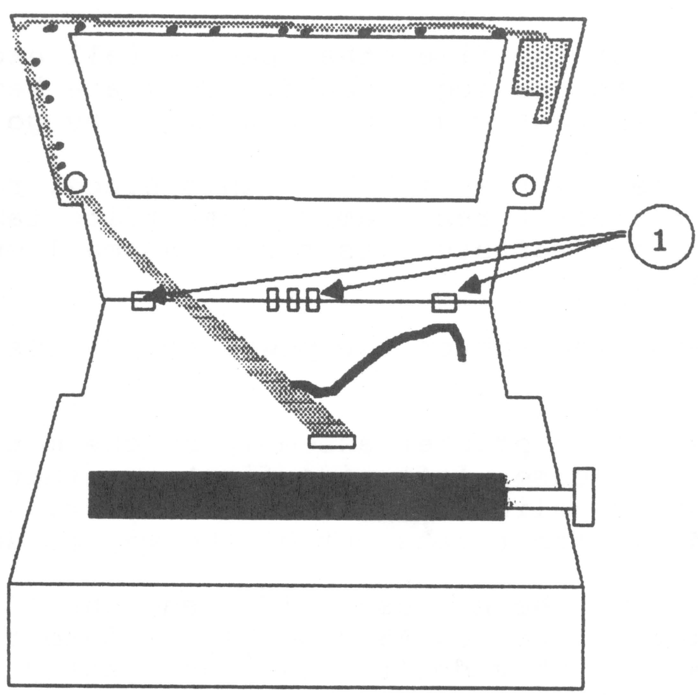


Figure 9

14. Replace and tighten the four screws at the corners of the black base-plate (Figure 8, #7). **NOTE:** These screws are all the same length. The similar but longer screw will be used later.

    CAUTION: Be careful not to catch any wires under the screw at the left rear.

15. Make sure the ribbon cable in the case cover is seated behind the posts along the inner edge of the case cover. (See Figure 9.)

16. Plug the ribbon cable into the logic board.

17. Fasten the ribbon cable's ground wire to the right rear corner of the chassis with the long screw (Figure 8, #8).

18. Replace the case cover as follows:

    a) Rest the back edge of the case cover on the back edge of the case, so that the tabs on the back edge of the cover are positioned properly (see Figure 9, #1).

    b) Lower the front of the case cover so that the back tabs catch. Be careful not to pinch any loose cables between the case cover and the case.

    c) Connect the ground wire at the right front of the baseplate and tuck it under the small grey clamp on the side of the case.

    d) Push the front of the case cover onto the two front tabs until they click into place and hold it firmly. (You will have to push hard.)

    e) Holding the case together, turn it upside down.

    f) Replace the two screws in the bottom of the case.

    g) Turn the case right side up.

19. Reinstall the platen knob.

20. Reinstall the ribbon cassette.

21. Reinstall the paper cover, front tabs first.

22. Place the printer on the paper tray.

CONTINUED ON NEXT PAGE

23. Install paper and run a self-test as follows:

    a) Make sure the power switch is in OFF position (up).

    b) Connect the power cord.

    c) Press the line/form feed switch and hold it down while pushing the power switch down. When the Scribe starts printing, release the line/form feed switch.

    The self-test will run until you turn the power off.

If the self-test will not run, re-open the case and check to make sure that you have correctly reinstalled all cables.

If the printer still does not function correctly, refer to **Section 4, Troubleshooting.**

REPLACING THE POWER SWITCH

Recommended Tools:

Needlenose pliers	Soldering iron
Medium Phillips screwdriver	60/40 rosin-core solder
Diagonal cutters	Wire strippers
X-acto knife	Heat gun

Heat-shrink tubing (3/16 inch diameter)

1. Remove the printer assembly from the case. (See procedure, above in this section.)

2. Remove the power switch (Figure 10, #1) from the right side of the printer assembly as follows:

   a) Remove the screw at the base of the power switch.

   b) If you push the switch to the right, you will notice that it is held to the printer by a twisted metal tab. Use needlenose pliers to straighten the tab, and then push the switch free.

   c) Carefully disengage the switch wires from their three plastic clamps.

3. Cut the leads free from the faulty switch. (See Figure 11, #1.) **NOTE:** Cut the leads as close to the switch as possible.

4. Remove and discard the old shrink tubing (Figure 11, #2).

5. Strip about 3/8 inch of new wire on each lead.

6. Put a 3/4-inch length of new shrink tubing on each lead.

7. Attach the leads to the terminals of the new switch (either lead to either terminal) as follows:

   a) Twist and tin a lead.

   b) Insert the lead through the hole in either terminal.

   c) Crimp the lead to ensure a good mechanical connection.

8. Solder the leads to the terminals.

9. Push the shrink tubing forward so that it covers the solder joint, and heat it with the heat gun until it shrinks to a snug fit around the joint.

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10. Reroute the leads under the three plastic clamps and put the new switch in place.

11. Reinstall the screw at the base of the switch, put the tab through its slot in the side plate, and put a slight twist in the tab to hold the switch in place.

12. Reassemble the printer and run the Loopback test to check the repair.

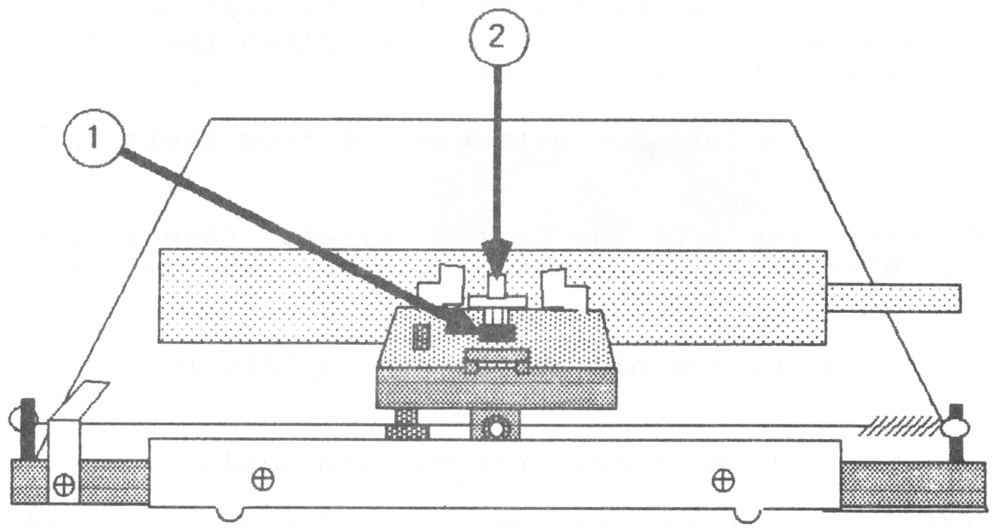


FIGURE 12

REMOVING AND REPLACING THE PRINT HEAD

Remove

1. Turn the power on to center the print head, then turn the power back off.

2. Follow steps 1 through 6 of "REMOVING THE PRINTER ASSEMBLY."

3. Grasp the print head connector (Figure 12, #1) by the sides and progessively pull up to disconnect it. Rocking the connector back and forth as you lift will make it easier to remove.

4. Grasp the print head (Figure 12, #2) by the sides and pull up to disconnect it.

5. Remove the rubber cap from the top of the print head connector. Put the cap in a safe place -- you will have to install it over the new print head's connector.

Replace

1. Install the rubber cap from the old print head connector over the new one.

2. Holding the print head by the sides, lower it into the grooves located at the front of the ribbon cassette holder. (See Figure 12.)

3. Carefully reconnect the print head connector to the circuit board connector at the center of the ribbon cassette holder. (See Figure 12, #2.)

4. Follow steps 18 through 22 of "CONNECTING THE LOGIC BOARD ASSEMBLY TO THE MECHANISM ASSEMBLY." (See page 2.13.)

5. Perform a Self Test to make sure that the Scribe is fuctioning properly. (See Section 4, Troubleshooting.)

CONTROL PANEL UPGRADE

As noted at the beginning of this section, there are two existing control panels for Scribe. In the one-piece control panel (original) version, the cable is soldered to the control panel, shielded with copper to pass RFI tests, and threaded through guides around the inside perimeter of the cover.

In the newer control panel version, the cable is separate from the control panel. It is mounted instead to the front of the mechanism assembly and runs underneath it to the logic board. This cable is attached to the mechanism assembly with double-sided tape. **When you exchange a mechanism assembly this cable must be returned with the mechanism assembly module.**

New (purchased from stock) or exchange mechanism assemblies will have the cable attached or the Upgrade Assembly will be included. If the Upgrade Assembly is included, then install it on the mechanism assembly. The Upgrade Assembly contains the cable and a nut, bolt, and clip to hold the cable in place on the mechanism assembly.

There are two possible situations which involve the Upgrade Assembly when the mechanism assembly is exchanged:

1. If the customer's printer has the original control panel installed, ignore the cable installed under the exchange mechanism assembly (but make sure it is disconnected from the logic board). Connect the original control panel cable to the logic board.

2. If the customer's printer has the new control panel installed, simply connect the new control panel to the cable mounted on the mechanism assembly and connect the other end of the cable running underneath the mechanism to the logic board.

NOTE: Be sure to install the Upgrade Assembly on the mechanism assembly. Both are included in the Spares Kit.

Scribe Printer Technical Procedures

Section 3

Adjustments

Contents:

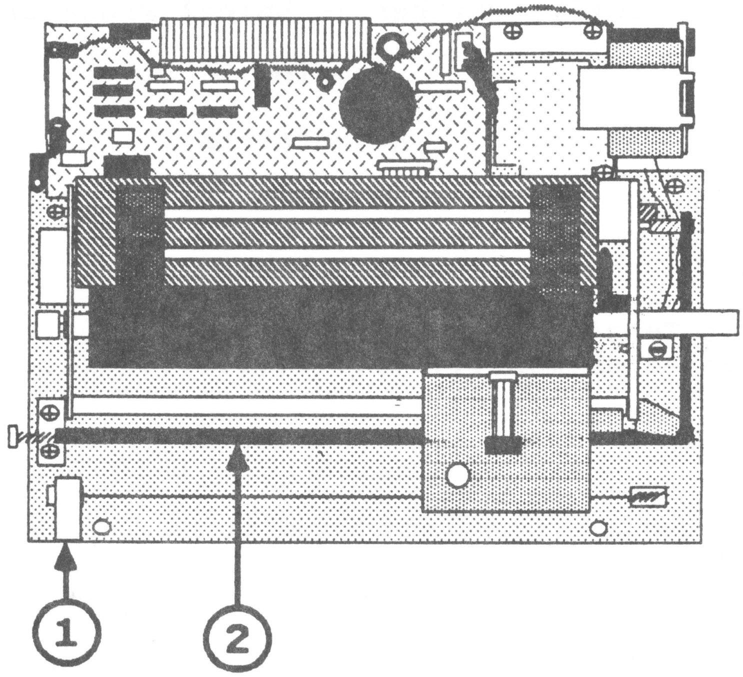


Figure 1

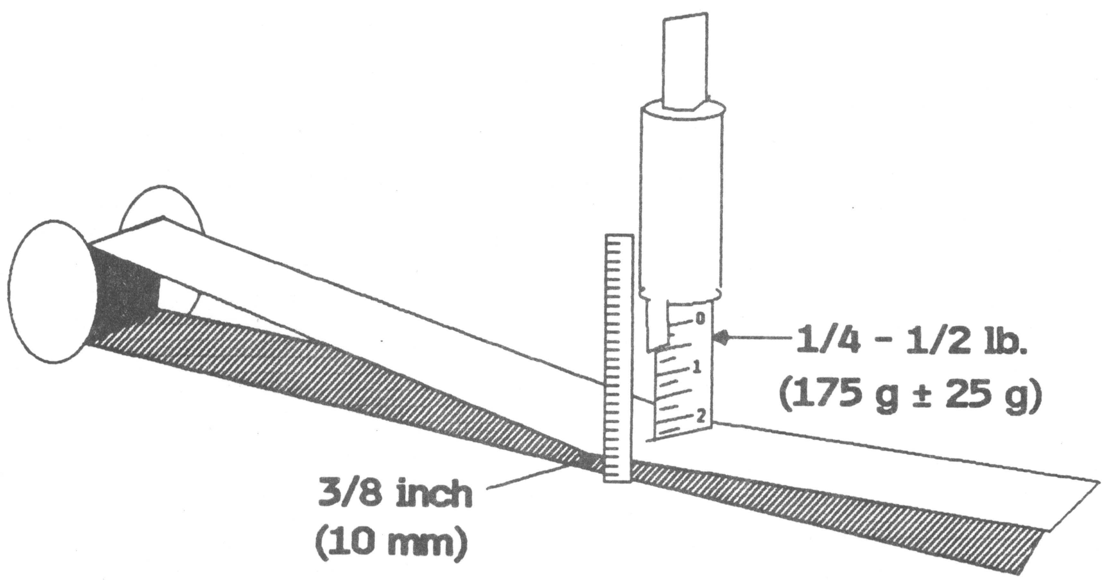


Figure 2

DRIVE BELT TENSION ADJUSTMENT

Required Tools: spring gauge (P/N 077-0014 or equivalent)
Metric ruler
5.5 mm nutdriver or wrench,
or small adjustable wrench
Medium Phillips screwdriver

The Scribe Printer often produces a small **horizontal registration** error (a slight unevenness line-to-line) at column 0 (the left margin). This unevenness is difficult to remove and should be considered normal. Horizontal registration errors (uneven vertical lines) elsewhere on the page are not acceptable and are correctable by adjusting the belt tension.

Faulty drive belt tension can also cause **home position** errors (see Section 4, **Troubleshooting**, p.4.6-4.8 for error indications). In the case of a home position error, make sure that the home position sensor switch (Figure 1, #1) is firmly attached to the chassis before you try the belt tension adjustment. If there is any play in the sensor switch mounting, tighten the screw. This may solve the problem without belt tension adjustment.

To Measure Belt Tension:

1. Remove power from the printer and disconnect the power cord.

2. Remove the printer cover.

3. Move the carriage assembly all the way to the right.

4. Position the spring gauge on the top portion of the drive belt, halfway between the carriage assembly and the left-hand belt pulley. (See Figure 1, #2.)

5. Press down on the drive belt with the gauge until the top of the belt is 10 millimeters (about 3/8 inch) from the bottom plate of the printer (see Figure 2). The spring gauge should read between 1/4 and 1/2 pound (175 g, + or - 25 g).

6. If the spring gauge reading is outside that range, tighten or loosen the belt according to the steps below.

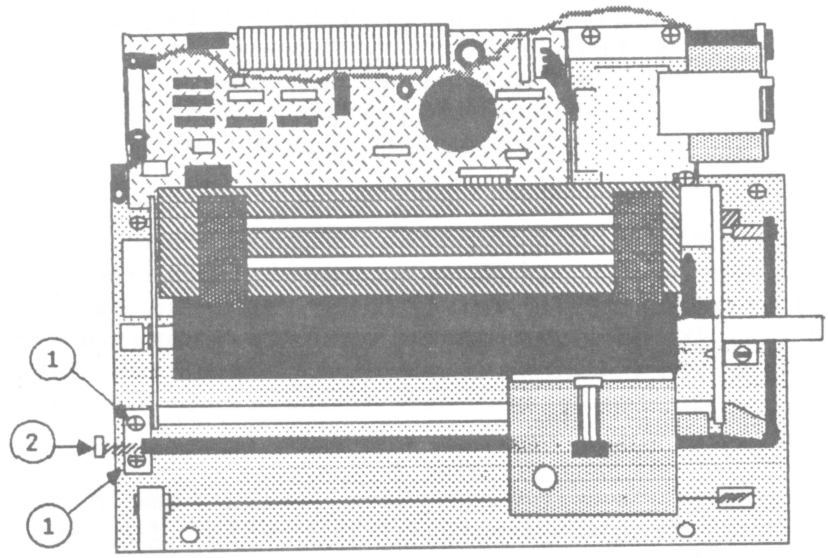
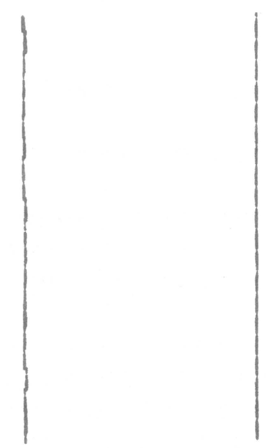


Figure 3



HORIZONTAL REGISTRATION

Figure 4

To Adjust Belt Tension:

1. Remove power from the printer and disconnect the power cord.

2. If you use a very thin 5.5 mm wrench, you may be able to reach the drive belt adjustment screw (Figure 3, #2) by removing the case cover only. Otherwise, remove the printer assembly from the case. (Refer to Section 2, **Take-Apart**, for instructions.)

3. To tighten or loosen the belt:

   a) Loosen the two belt pulley screws (Figure 3, #1).

   b) Turn the drive belt adjustment screw (Figure 3, #2) clockwise to tighten, or counterclockwise to loosen the belt.

   c) Tighten the two belt pulley screws (to prevent measurement error).

   d) Measure the tension again and repeat steps a-c if necessary.

   e) When the tension is correct, make sure the two belt pulley screws are tightened.

4. Test the adjustment by printing a sample file that includes straight vertical lines. (See Figure 4 for samples of good and poor horizontal registration.) If the lines are not straight (except at the left margin), readjust the belt tension until they are.

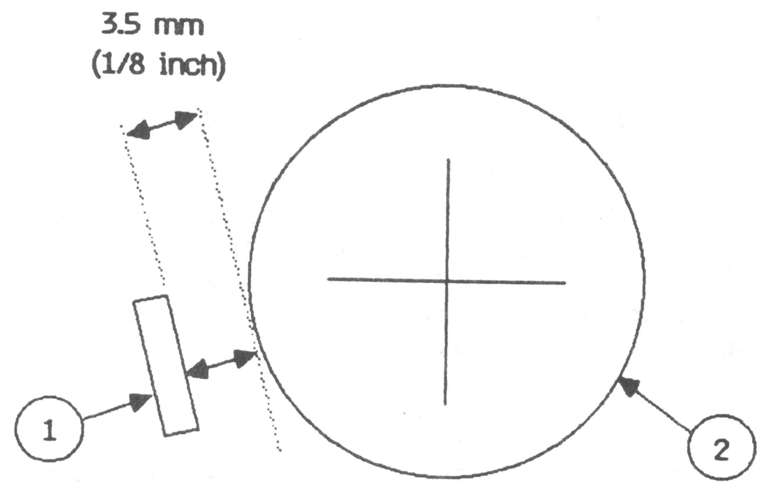


Figure 5

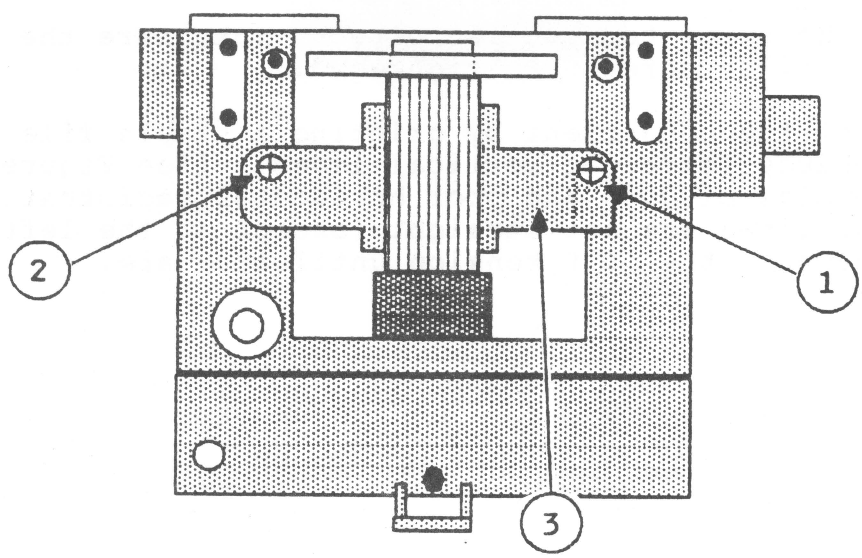


Figure 6

PRINT HEAD ADJUSTMENT

If the print head is too far from the platen, printing will be uniformly light. If it is too close, printing may be too black and overlaid with a grey smear.

Measuring the print head gap

1. Remove the ribbon cassette from the printer.
2. Remove the clear plastic paper guide from the left-hand side of the carriage assembly (it pulls off).
3. Measure the distance between the print head (Figure 5, #1) and the platen (Figure 5, #2). The gap should be 3.5 mm, + or - 0.5 mm (about 1/8 inch).

Adjusting the print head gap

1. Remove the ribbon cassette from the printer.
2. Loosen but do not remove the adjustment screw on the right (Figure 6, #1).
3. Loosen the left-hand screw (Figure 6, #2) just enough to allow movement of the print head positioning plate (Figure 6, #3). (It pivots at the left side and moves at the right.)
4. Move the print head forward or back until the gap is correct (3.5 mm or 1/8 inch).
5. Tighten the screws.
6. Measure again to verify adjustment. Readjust if necessary.
7. Run the self-test to verify that the adjustment has solved the problem. Readjust if necessary.
8. Make sure to reinstall the clear plastic paper guide when you finish.

Scribe Printer Technical Procedures

Section 4

Troubleshooting

Contents:

NOTE: The Scribe printer should be tested the Apple II Peripherals Diskette. (See **Multi-Product Diagnostics Technical Procedures, Section 1.**)

To troubleshoot the SCRIBE printer, first perform the Initial Checks below; then if the problem is not found, try running the self-test and use the SYMPTOM TABLES to diagnose the problem. All repairs must be verified by passing the self-test.

Initial Checks

Inspect everything visually, including:

	Item	Check for
_____	Power Cord (if available)	insulation cracks evidence of burning misformed from excessive bending ground plug missing from power cord
_____	Printer Case	burn marks case has been opened by user evidence of having been dropped (cracks in case, paper tray, or cover)
_____	Ribbon Cassete	no ribbon installed out of ribbon ribbon torn ribbon drive cable broken
_____	Print Head	print head appears damaged print head cable incorrectly installed
_____	Platen	platen dirty or damaged labels stuck on platen paper or labels stuck in feed path

Self-Test

1. Make sure paper is installed; press and hold down the LINE/FORM FEED key on the control panel and then turn the power on. The printer should print a repetitive alpha-numeric pattern.

2. If the self-test does not pass or if the print quality is poor, note the symptoms and go to the SYMPTOM TABLES

Instructions for Using the Symptom Tables

Equipment Required:

- Phillips screwdriver
- flatblade screwdriver
- needlenose pliers
- ruler
- loopback connector
- IC extractor (Apple PN# 918-0017)
- Tension gauge (Apple PN# 077-0014)

Procedures:

1. Locate the symptom in the tables that most nearly matches the observed symptoms of the printer being repaired.

2. Perform the corrective actions, in the sequence listed, until the failure has been diagnosed and repaired. If the problem is not found using the corrective actions given, locate another symptom that is similar, and follow the corrective actions for that symptom.

3. If the symptoms you observe are not found in the tables, replace the logic board (it can cause the greatest variety of symptoms).

NOTE: The word "check", as used in the tables, means to visually inspect and/or manually test for loose connections, burned components, mechanical binding, breaks or tears, looseness or tightness, etc.

When the tables say to "replace" a module, be sure to return the original module to the system if the replacement did not repair the problem. Do this before you replace another module. The tables are given in the following pages.

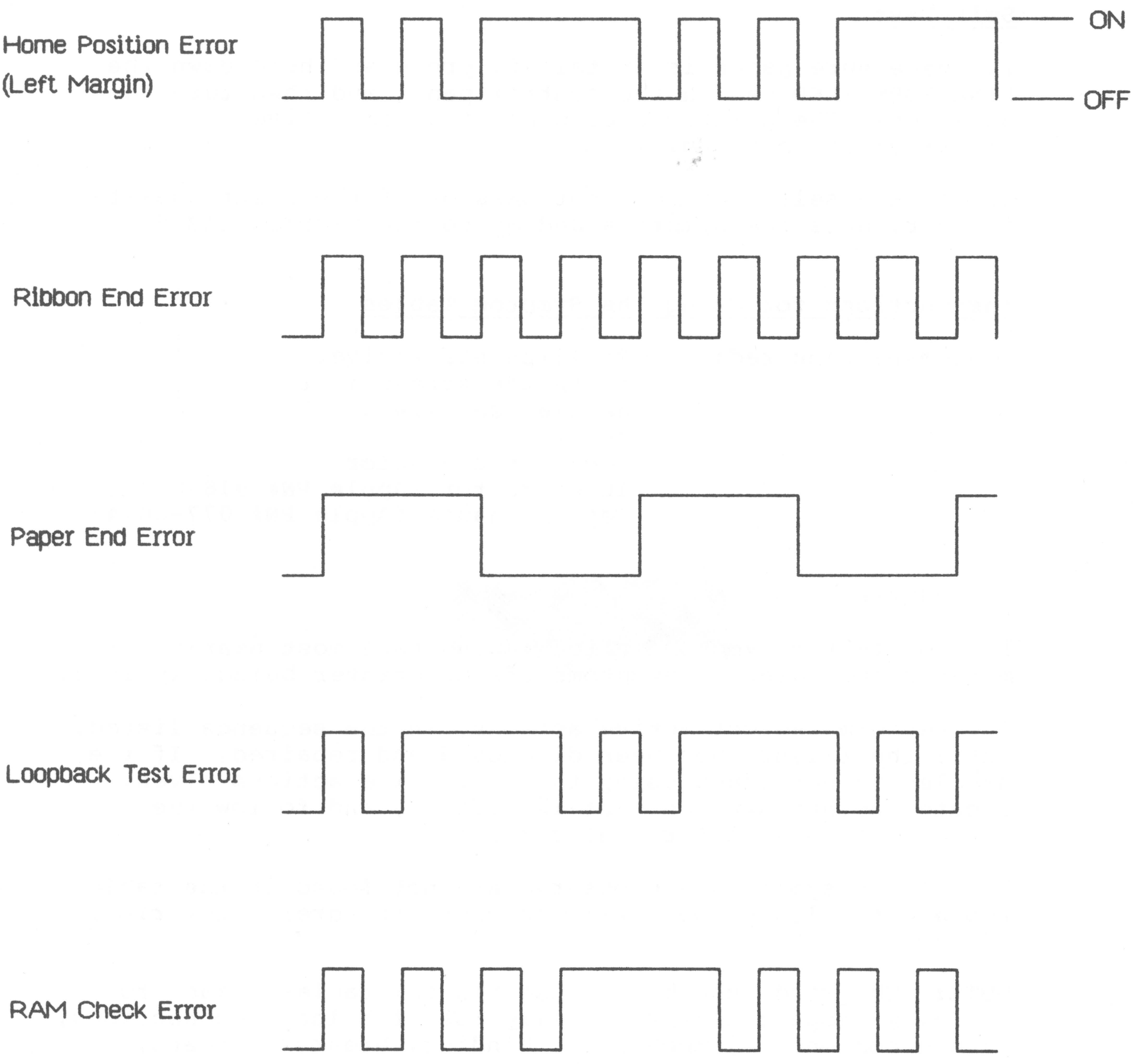

Home Position Error
(Left Margin)
ON
OFF
Ribbon End Error
Paper End Error
Loopback Test Error
RAM Check Error

FIGURE 1

SYMPTOM TABLES

ERROR CONDITIONS

Certain error conditions are indicated by the SELECT lamp on the Scribe control panel blinking on and off in various patterns. Figure 1 indicates the different patterns and their meanings.

SYMPTOM	CORRECTIVE ACTION
Select lamp flashes slowly (Paper End Error)	1. paper is out, insert paper 2. paper is inserted too far to the right 3. clean paper detect sensor 4. replace logic board 5. replace mechanism assembly due to a defective paper detect sensor
Select lamp flashes rapidly (Ribbon End Error)	1. remove and reseat ribbon cassette 2. replace ribbon cassette and press select switch 3. replace mechanism assembly, due to a defective out of ribbon detect sensor 4. replace logic board
Select lamp flashes rapidly three times followed by a pause and then three more rapid flashes (Ram Check Error)	1. replace logic board

SYMPTOM	CORRECTIVE ACTION
Select lamp flashes rapidly two times followed by a pause and then two more rapid flashes (Home Position Error)	1. check that nut on left drive belt pulley is not overtightened. 2. check carriage belt tension 3. replace mechanism assembly
Select lamp flashes once followed by a pause and then another flash (Loopback Test Error)	1. check loopback connector is securely connected 2. replace logic board
Select lamp flashes very fast (no error condition); printer doesn't operate	1. replace ribbon 2. replace logic board
Select lamp lit continuously, carriage does not move	1. check baud rate setting of DIP switch 2. replace interface cable 3. replace logic board

PRINT QUALITY PROBLEMS

SYMPTOM	CORRECTIVE ACTION
Print is light	1. check that the type of paper being used is appropriate (refer to User's manual) 2. check DIP switch setting is appropriate for paper type being used (refer to User's Manual) 3. replace ribbon cassette with new one 4. check ribbon drive wire is connected and drive pulley is turning 5. check print head is clean 6. check print head gap 7. replace print head 8. replace ribbon drive wire 9. replace logic board
Print is dark	1. check DIP switch setting is appropriate for paper type being used 2. replace print head 3. replace logic board
Print density varies while printing on any type of paper	1. replace ribbon cassette 2. check ribbon feed mechanism, and replace mechanism assembly if defective 3. check ribbon drive wire

SYMPTOM	CORRECTIVE ACTION
Printer prints solid black line but operates normally otherwise	1. replace print head 2. replace logic board
Improper vertical spacing, prints on top of another line	1. check paperfeed motor and gears for binding 2. check platen and platen gear 3. check pin feed tractor
Poor horizontal print registration	1. check tension of carrier belt
Printing distorted	1. check that the correct type of paper is used (try smoother paper) 2. check for proper feeding of paper 3. check that print head is clean 4. replace print head 5. replace mechanism assembly
Excessive background (smudge) when no printing is present	1. replace ribbon with new one 2. check DIP switch settings 3. adjust print head gap
Platen does not turn, prints over same line	1. check DIP switch settings 2. check paper feed gears 3. check for objects obstructing the feed path 4. check paper feed motor connector (CN5) is securely connected to logic board

ABNORMAL PRINTER OPERATION

SYMPTOM		CORRECTIVE ACTION
Carriage doesn't move; power lamp not lit	1.	check power cord plugged in securely
	2.	check line fuse (on outside of case, near power cord connector)
	3.	check fuse FU2 on logic board
	4.	replace logic board
	5.	replace AC power switch
	6.	return unit to Level 2 for replacement of noise filter or transformer
Power lamp on, all other lamps off and printer doesn't operate	1.	replace logic board
All control panel lamps are lit, but printer doesn't operate	1.	replace print head
	2.	replace logic board
Power lamp not lit but carriage moves and prints normally	1.	check that the control panel connector (CN7) is securely connected to the logic board
	2.	replace control panel board

SYMPTOM		CORRECTIVE ACTION
Carriage moves, but does not print	1.	check ribbon installed for plain paper printing
	2.	if no ribbon installed, check that thermal paper has the thermal side facing the print head
	3.	check the print head cable is properly connected
	4.	replace thermal print head
	5.	replace logic board
Abnormal noise when printer is turned on	1.	check for objects that may have dropped into printer
	2.	check drive belt for tear or looseness
	3.	check for broken or misaligned gears
	4.	check for loose/dirty carriage shaft
	5.	check for defective connections at CN3, CN4, and CN6 by lightly moving connector wires
	6.	replace logic board
Humming noise when printer is turned on; printer does not operate; all indicator lamps are lit	1.	check that the print head cable is correctly installed
	2.	replace logic board

SYMPTOM		CORRECTIVE ACTION
Paper feed is irregular	1.	check release lever is set to proper position
	2.	check paper is inserted correctly
	3.	check proper paper type is being used (card stock and onion skin types are not recommended)
	4.	check for proper spacing between sprockets (when using pin feed - refer to chapter 2 of the User's Manual)
	5.	check for broken tractor pins
	6.	check platen gear for cracks or binding
	7.	Check print head gap
	8.	lubricate platen bearings
	9.	replace logic board
Paper does not feed	1.	check motor gears for looseness or damage
	2.	check sprocket gears for looseness or damage
	3.	check paper feed motor connector (CN5) is securely connected to logic board
	4.	replace logic board

SYMPTOM		CORRECTIVE ACTION
Control panel keys do not operate properly	1.	check control panel cable connector (CN7) is securely connected to the logic board
	2.	replace control panel
	3.	replace logic board
Prints without paper	1.	clean paper detect sensor
	2.	replace mechanism assembly due to a defective paper detect sensor
	3.	replace logic board
Carriage strikes against end	1.	check that nut on left drive belt pulley is not overtightened.
	2.	check drive belt tension
	3.	check home position switch; replace mechanism assembly if defective
	4.	check connector (CN8) securely connected
	5.	replace logic board
Carriage moves to center and stops after power is turned on	1.	install paper and/or ribbon cassette
	2.	replace logic board
Carriage moves to right when power is turned on, and then stops	1.	replace logic board
Print head "taps" platen once when power is turned on, and printer doesn't operate	1.	replace logic board

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SYMPTOM		CORRECTIVE ACTION
Printer does not operate and print head taps the platen once when power is turned off	1.	replace logic board
Print head engages into platen and stays, printer does not operate further	1.	replace logic board
	2.	check printhead after replacement of logic board is made
Carriage "jumps" once when power is turned on and then doesn't operate	1.	replace logic board
Printer does not operate and platen roller reverse feeds when power is removed	1.	replace logic board
Carriage jumps around then stops, when power is turned on	1.	replace logic board

Scribe Printer Technical Procedures

Section 6

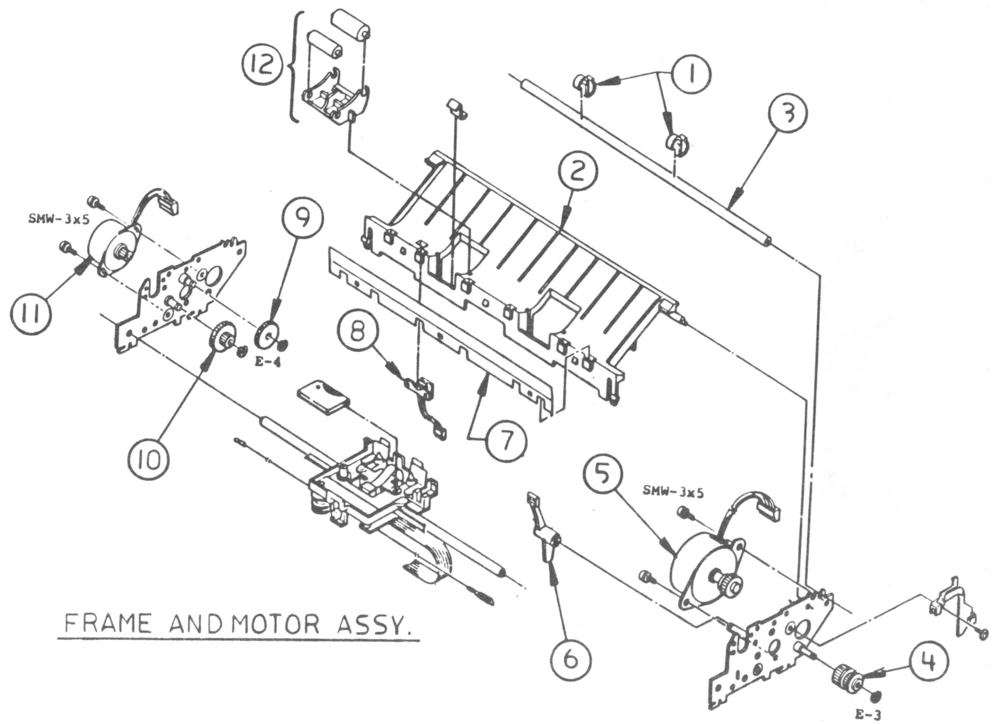
Illustrated Parts List

The figures and lists below include all piece parts that can be purchased separately from Apple for the Scribe Printer, along with their part numbers. These are the only parts available from Apple. Refer to your Apple Service Programs manual for prices.

Contents:

REV.	ZONE	ECO #	REVISION	APPD	DATE
A		S666	INITIAL RELEASE		

NOTE: UNLESS OTHERWISE SPECIFIED



FRAME AND MOTOR ASSY.

Figure 1

METRIC

DIMENSIONS ARE IN MILLIMETERS
TOLERANCES
X ±
XX ±
XXO ±
ANGLES ±
DO NOT SCALE DRAWING

MATERIAL	FINISH
DRFT Tom Anyu 3/85	DRFT CK
ENG APPVL	MFG APPVL
RELEASE	ORIG DIV SERVICE
DESIGNER	SCALE N/A

TITLE ILLUSTRATED PARTS LIST SCRIBE

SIZE B — DRAWING NUMBER 070-0230-A — SHT 1/7

SCRIBE PRINTER, FRAME & MOTOR ASSEMBLY (Figure 1)

Item	Part No.	Description
1	970-0943	Clip, Wire Harness
2	970-0949	Pan, Paper Feed
3	970-0911	Shaft, Frame Support
4	970-0935	Pulley, Carriage Drive
5	970-0962	Motor, Carriage Drive
6	970-0929	Lever, Feed Roller Release
7	970-0916	Plate, Paper Deflector
8	970-0971	Sensor Assembly, Out of Paper Detect
9	970-0927	Gear, Idler
10	970-0925	Gear, Idler/Platen Drive
11	970-0963	Motor, Paper Feed
12	970-0956	Feed Roller Assembly

NOTE: UNLESS OTHERWISE SPECIFIED

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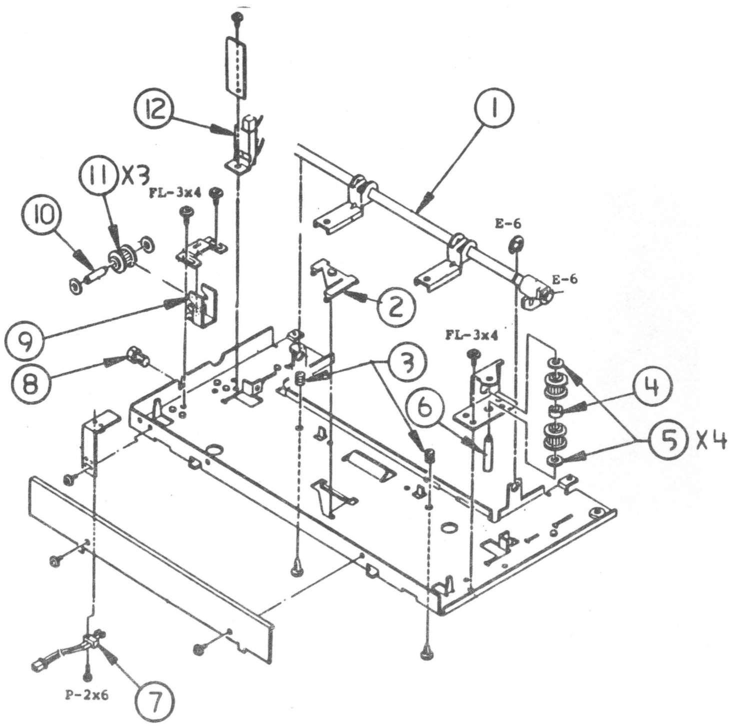


Figure 2

METRIC

DIMENSIONS ARE IN MILLIMETERS
TOLERANCES
X ± ____ XX0± ____
XX ± ____ ANGLES ± ____
DO NOT SCALE DRAWING

MATERIAL:	FINISH:
DRFT	DRFT CK
ENG APPVL	MFG APPVL
RELEASE	ORIG DIV
DESIGNER	SCALE

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SIZE	DRAWING NUMBER	SHT
B	070-0230-A	2/7

DRAWING NUMBER 070-0230-A SHT 2/7

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SCRIBE PRINTER, BASE ASSEMBLY (Figure 2)

Item	Part No.	Description
1	970-0969	Shaft Assembly, Feed Roller Release
2	970-0944	Retainer, Ribbon Cable
3	970-0899	Spring, Feed Roller
4	970-0928	Coller, Carriage Drive Pulley
5	970-0903	Washer, Carriage Drive Pulley
6	970-0907	Shaft, Pulley Mounting
7	970-0966	Switch, Home Position
8	423-2001	Screw, Hex Hd, 3.0 x .50 x 12
9	970-0915	Plate, Carriage Drive Pulley Mounting
10	970-0908	Shaft, Carriage Drive Pulley
11	970-0936	Pulley, Carriage Drive, Inverter
12	970-0961	Resistor Assembly, 5 Watt Ceramic

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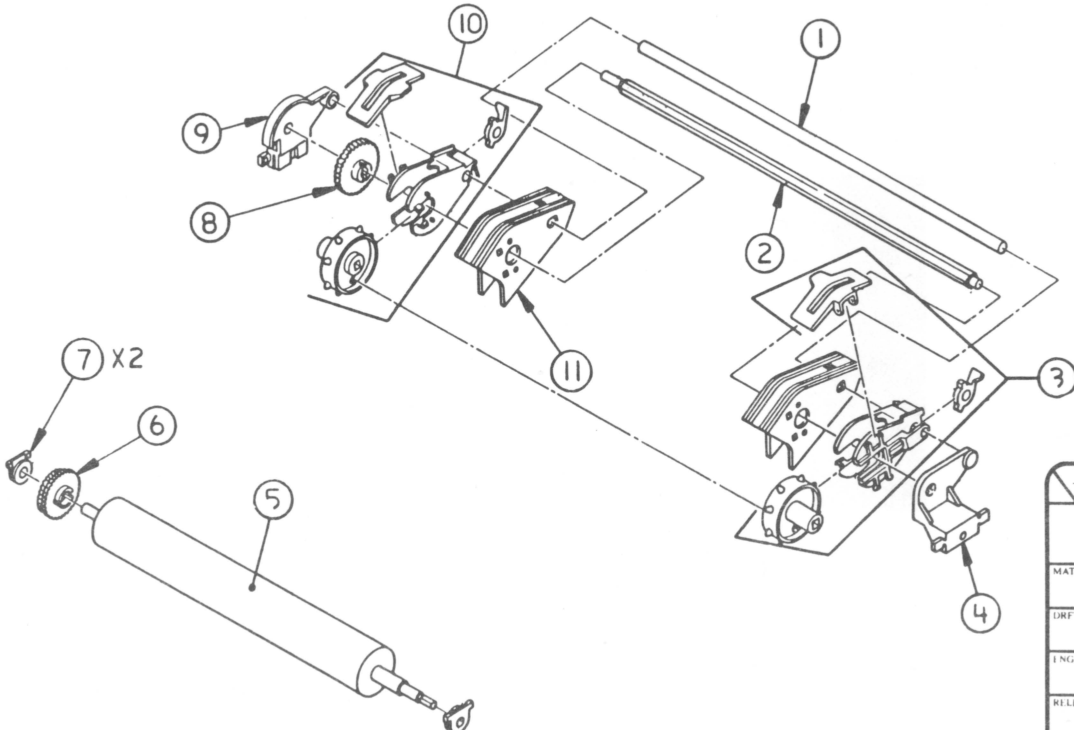


Figure 3

METRIC

DIMENSIONS ARE IN MILLIMETERS
TOLERANCES
X ____ XXO± ____
XX ____ ANGLES ____
DO NOT SCALE DRAWING

MATERIAL	FINISH
DRFT	DRFT CK
ENG APPVL	MFG APPVL
RELEASE	ORIG DIV
DESIGNER	SCALE

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TITLE: ILLUSTRATED PARTS LIST SCRIBE

SIZE: B | DRAWING NUMBER: 070-0230-A | SHT 3/7

DRAWING NUMBER 070-0230-A SHT 3/7

SCRIBE PRINTER, TRACTOR & PLATEN ASSEMBLY (Figure 3)

Item	Part No.	Description
1	970-0910	Shaft, Tractor Support
2	970-0913	Shaft, Tractor Assembly Drive
3	970-0960	Tractor Assembly, R.H.
4	970-0924	Frame, R.H. Tractor Assy
5	970-0906	Platen Roller, Rubber
6	970-0926	Gear, Platen Drive
7	970-0930	Bearing, Platen Holder
8	970-0980	Gear, Tractor Drive
9	970-0923	Frame, L.H. Tractor Assembly
10	970-0959	Tractor Assembly, L.H.
11	970-0947	Guide, Paper/Tractor

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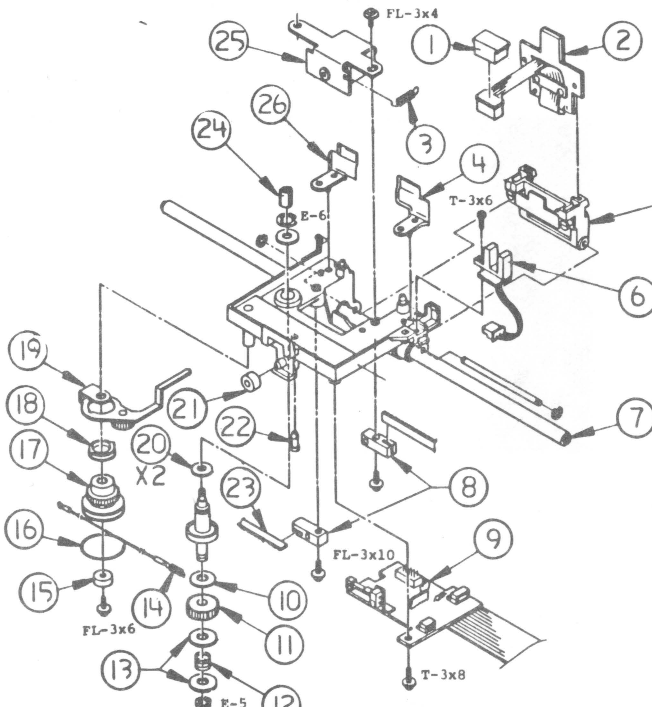


Figure 4

METRIC	
DIMENSIONS ARE IN MILLIMETERS TOLERANCES X ___ XXO± ___ XX ___ ANGLES ___ DO NOT SCALE DRAWING	
MATERIAL	FINISH
DRFT	DRFT CK
ENG APPVL	MFG APPVL
RELEASE	ORIG DIV
DESIGNER	SCALE

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SIZE	DRAWING NUMBER	SHT
B	070-0230-A	4/7

DRAWING NUMBER 070-0230-A SHT 4/7

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A19997

SCRIBE PRINTER, CARRIAGE ASSEMBLY (Figure 4)

Item	Part No.	Description
	970-0975	Carriage Assembly, Complete, w/o Printhead
1	970-0955	Cap, Print Head, Rubber
2	076-0090	Print Head Assembly
3	970-0972	Spring, Solenoid Assembly
4	970-0922	Guide, Paper Holder, R.H.
5	970-0957	Mounting Assembly, Print Head
6	970-0965	Sensor Assembly, Out of Ribbon Detect
7	970-0909	Shaft, Carriage
8	970-0918	Clamp, Carriage Drive Belt
9	970-0970	PCB, Carriage Assembly w/Cable
10	970-0945	Washer, Ribbon Feed Friction
11	970-0919	Gear, Ribbon Take-up
12	970-0900	Spring, Ribbon, Clutch/Take-up
13	970-0914	Washer, Ribbon Take-up
14	076-0097	Spring Assembly, Ribbon Cable
15	970-0912	Collar, Ribbon Clutch
16	076-0096	Cable Assembly, Ribbon Feed
17	970-0920	Gear, Ribbon Clutch Drive
18	970-0917	Gear, Metal Ribbon Clutch Feed
19	970-0958	Gear Assembly, Ribbon Feed Correction
20	970-0940	Washer, Ribbon Feed
21	970-0937	Bearing, Carriage Assembly
22	970-0921	Actuator, Ribbon Box Detect
23	076-0095	Belt Assembly, Carriage Drive
24	970-0938	Capstain, Ribbon Drive
25	970-0964	Solenoid Assembly, Print Head
26	970-0939	Guide, Paper Holder, L.H.

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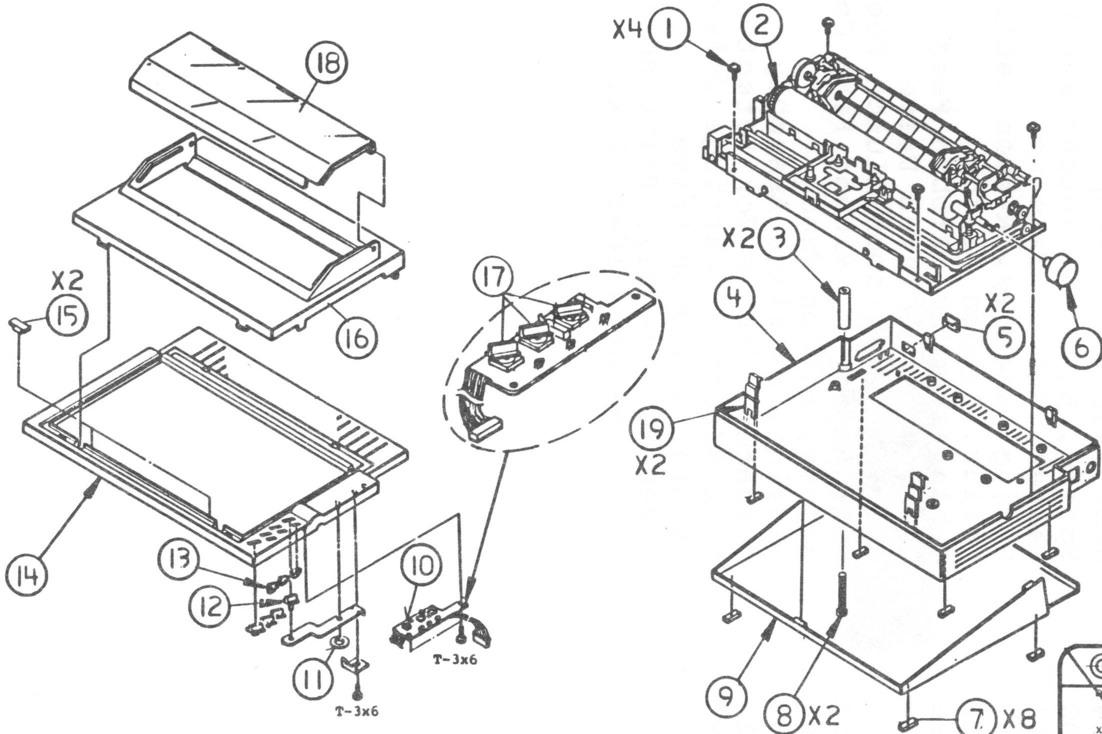


Figure 5

METRIC

DIMENSIONS ARE IN MILLIMETERS
TOLERANCES
X ___ .XXO± ___
.XX ___ ANGLES ___
DO NOT SCALE DRAWING

MATERIAL	FINISH
DRFT	DRFT CK
ENG APPVL	MFG APPVL
RELEASE	ORIG DIV
DESIGNER	SCALE

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DRAWING NUMBER 070-0230 - A SHT 5/7

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SCRIBE PRINTER, COVERS (Figure 5)

Item	Part No.	Description
1	076-0089	Screw Assembly, Misc.
2	661-75218	Mechanism Assembly w/o Printhead
3	970-0978	Spacer, Cover
4	970-0973	Cover Assembly, Bottom
5	970-0948	Plug, DIP Switch
6	970-0934	Knob, Platen
7	076-0094	Feet Assembly, Rubber
8	076-0089	Screw Assembly, Misc
9	970-0967	Tray Assembly, Paper
10	076-0093	Control Panel Assembly
11	970-0904	Nut, Push
12	970-0933	Button, Power Switch
13	970-0932	Lens, Control Panel, LED
14	970-0968	Cover Assembly, Top
15	970-0946	Plug, Top Cover, Snap
16	970-0951	Cover, Printer
17	970-0931	Button, Control Panel
18	970-0952	Lid, Printer Cover
19	970-0974	Clip, Bottom/Top Cover

NOTE: UNLESS OTHERWISE SPECIFIED

REV.	ZONE	ECO #	REVISION	APPD	DATE

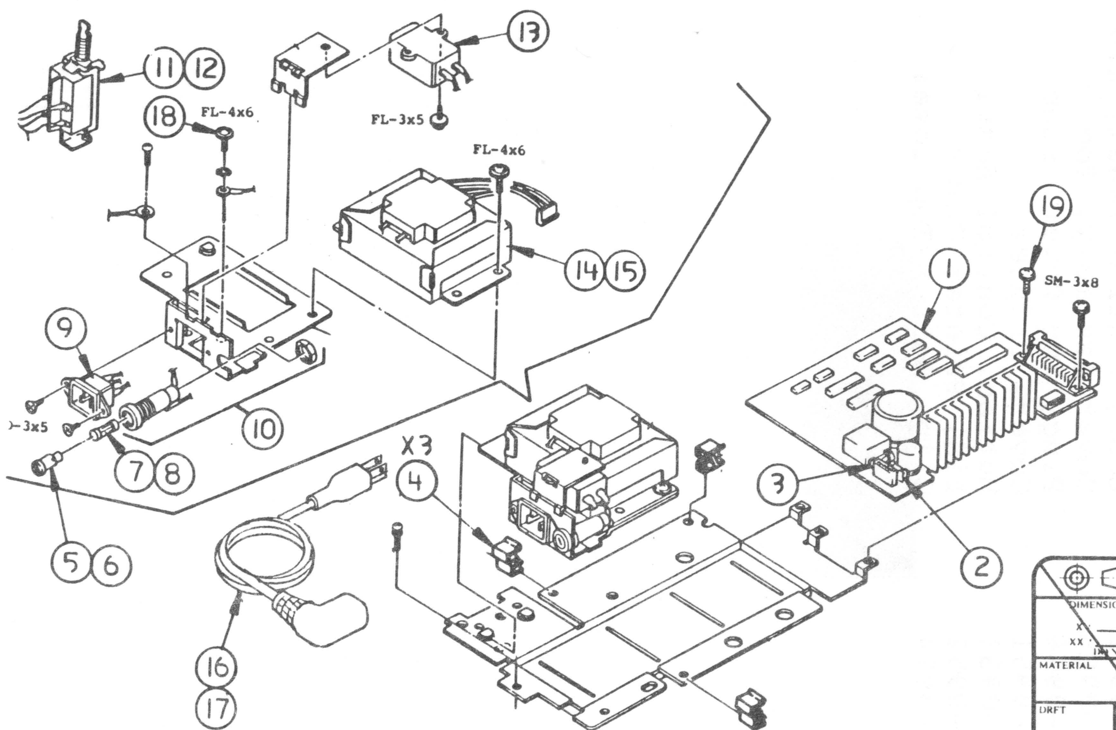


Figure 6

METRIC

DIMENSIONS ARE IN MILLIMETERS
TOLERANCES
X — XXO± —
XX — ANGLES —
DO NOT SCALE DRAWING

MATERIAL	FINISH
DRFT	DRFT CK
ENG APPVL	MFG APPVL
RELEASE	ORIG DIV
DESIGNER	SCALE

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TITLE ILLUSTRATED PARTS LIST SCRIBE

SIZE	DRAWING NUMBER	SHT
B	070-0230-A	6/7

SCRIBE PRINTER POWER SUPPLY & MAIN LOGIC BOARD (FIGURE 6)

Item	Part No.	Description
1	661-75217	Main Logic PCB
2	740-0400	Fuse, 2A, 125V, Slow Blow
3	740-0401	Fuse, 4A, 125V, Slow Blow
4	970-0942	Clip, PCB Guide
5	970-0712	Cap, Fuse, 110V
6	970-0713	Cap, Fuse, 220V
7	740-0101	Fuse, 2A, 250V
8	740-0100	Fuse, 1A, 250V
9	970-0902	Holder, AC Fuse
10	970-0983	Receptacle, AC Input
11	076-0091	Power Switch Assembly, 110V
12	076-0092	Power Switch Assembly, 220V
13	970-0901	Noise Filter, AC Line
14	970-0953	Transformer, AC Line, 115V
15	970-0954	Transformer, AC Line, 220V
16	970-0635	Power Cord, 110V
17	970-0710	Power Cord, 220V
18	076-0089	Screw Assembly, Misc.
19	076-0089	Screw Assembly, Misc.

NOTE: UNLESS OTHERWISE SPECIFIED

REV.	ZONE	ECO #	REVISION	APPD	DATE

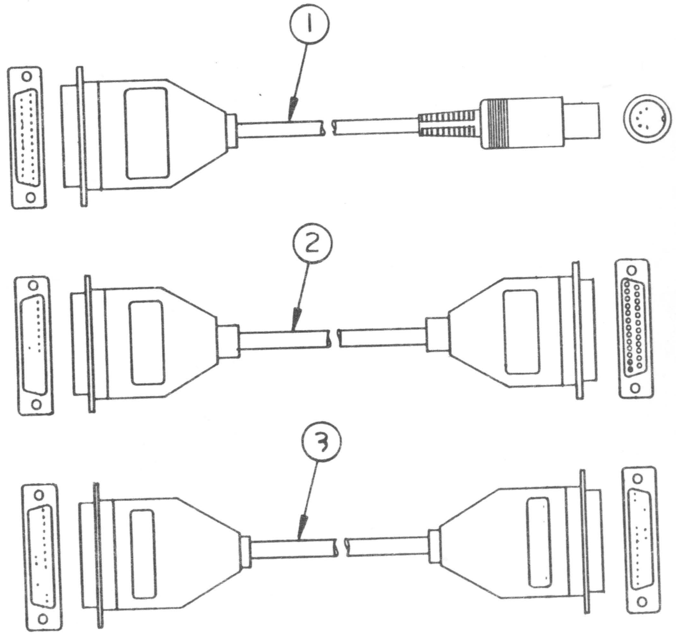


Figure 7

METRIC

DIMENSIONS ARE IN MILLIMETERS
TOLERANCES
.X
.XX
.XXO±
ANGLES
DO NOT SCALE DRAWING

MATERIAL | FINISH
DRFT | DRFT CK
ENG APPVL | MFG APPVL
RELEASE | ORIG DIV
DESIGNER | SCALE

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DRAWING NUMBER: 070-0230-A | SHT: 7/7

apple computer

SCRIBE PRINTER, CABLES (Figure 7)

Item	Part No.	Description
1	590-0191	Cable, Printer Interface AIIc
2	590-0166	Modem Eliminator Cable Assembly
3	590-0199	Serial Interface Cable Assembly

Scribe Printer Technical Procedures

Section 2: Take-Apart

Appendix A: Optional Procedures

Contents:

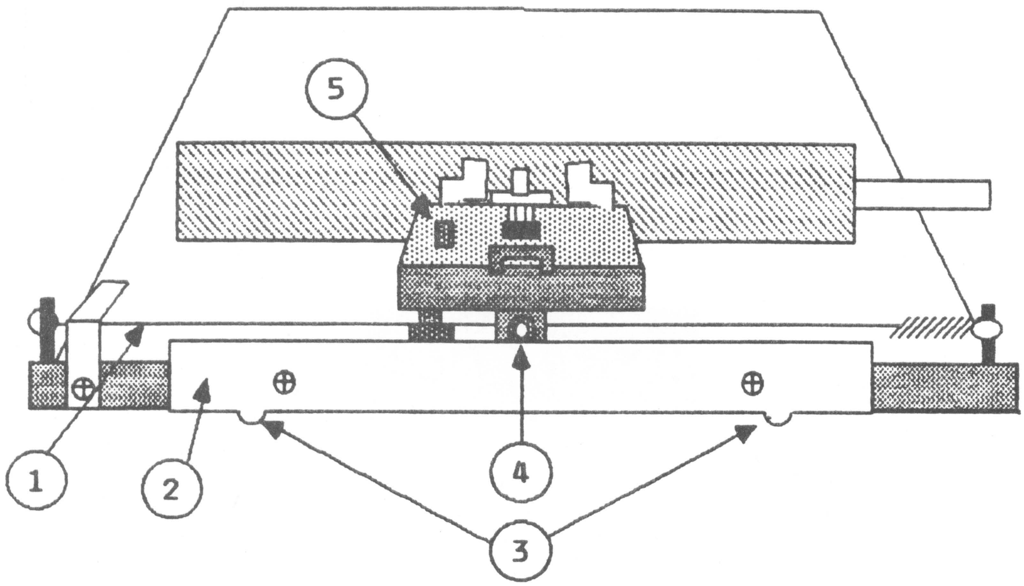


Figure 1

apple computer

REPLACING THE RIBBON DRIVE WIRE

Required Tools: medium Phillips screwdriver

NOTE: This procedure is optional at Level 1.

The ribbon drive wire (Figure 1, #1) is a thin, clear nylon filament, like fishing line, that turns a pulley to advance the ribbon as the carriage moves. If it breaks or becomes otherwise unusable, replace it as follows.

To Remove:

1. Remove the printer assembly from the case (see Take-Apart procedures).

2. Remove the front guide bar (Figure 1, #2) from the mechanism assembly by removing its two screws.

IMPORTANT: Before removing the ribbon drive wire, note how it is routed around the ribbon drive pulley underneath the carriage assembly.

3. Grasp the spring at the right of the ribbon drive wire and remove it from its post.

4. Remove the spring from the wire.

5. Remove the wire from the pulley.

6. Remove the left side of the wire from its post.

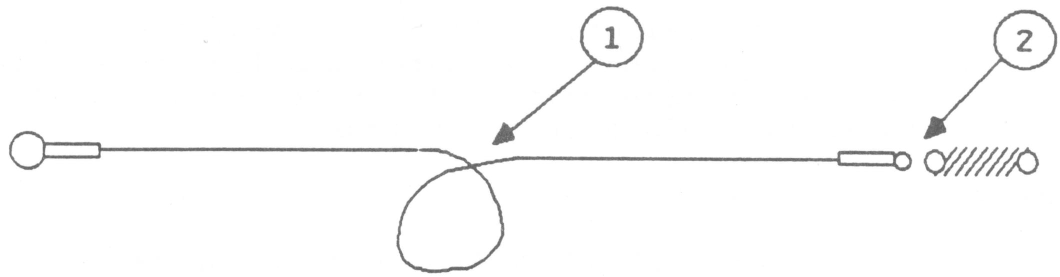


Figure 2

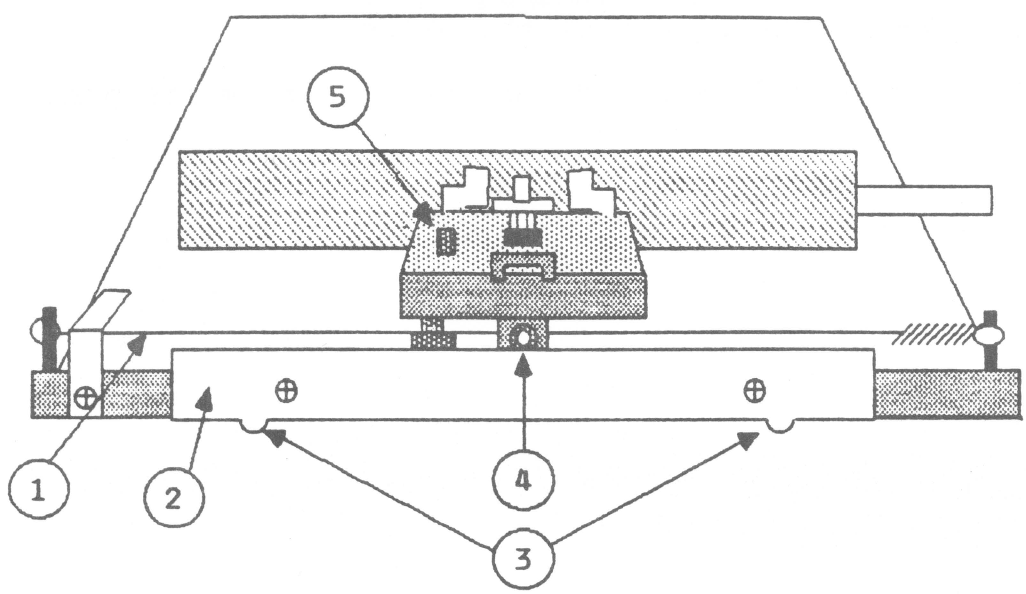


Figure 1

To Replace:

1. Hook the large end-loop on the wire around the left post. Make sure the end-loop fits into the slots on the post.

2. Make a loop in the wire (see Figure 2) and fit it around the ribbon drive pulley beneath the carriage assembly. Make sure the crossover in the loop (Figure 2, #1) is at the rear of the pulley.

3. Pull the wire taut, so that it stays in place around the pulley.

4. Hook the **smaller** end-loop of the new wire through one hook of the spring. (See Figure 2, #2.)

5. Hook the spring to the right-hand post. Make sure the spring fits into the groove in the post.

6. Make sure the wire and spring look straight on both sides. If not, adjust them.

7. Replace the front guide bar as follows:

   a) Rest the front roller of the carriage assembly on top of the front guide bar. (See Figure 1, #4.)

   b) Line up the tabs on the guide bar (Figure 1, #3) with the tabs on the baseplate of the mechanism assembly.

   c) Replace and tighten the two screws in the front guide bar.

8. To check that the installation was correct, press the print head against the platen with your finger while you move the carriage assembly across its track. The ribbon drive capstan (Figure 1, #5) should turn as the carriage moves from left to right. If it doesn't, readjust the wire.

9. Replace the printer assembly in the case (see procedure above).

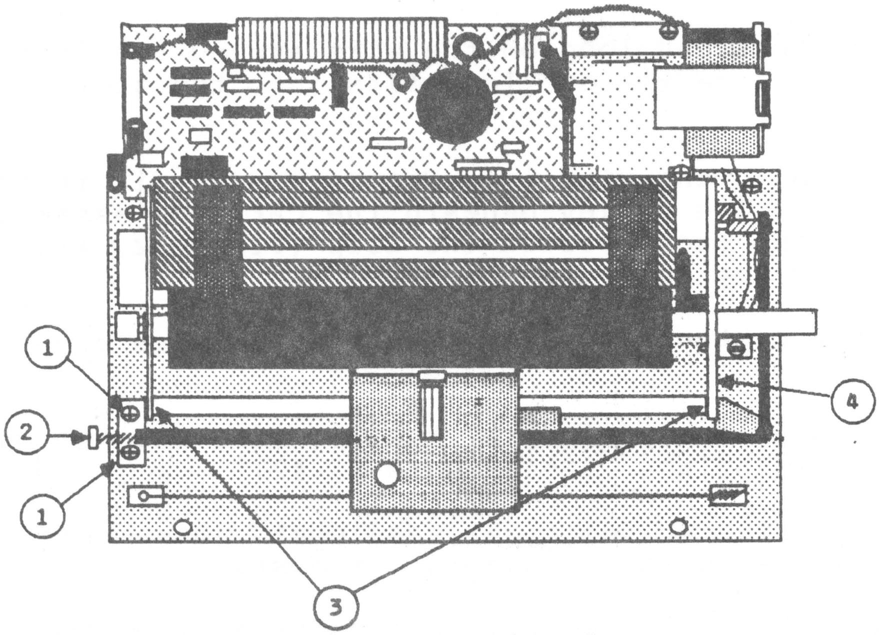


Figure 3

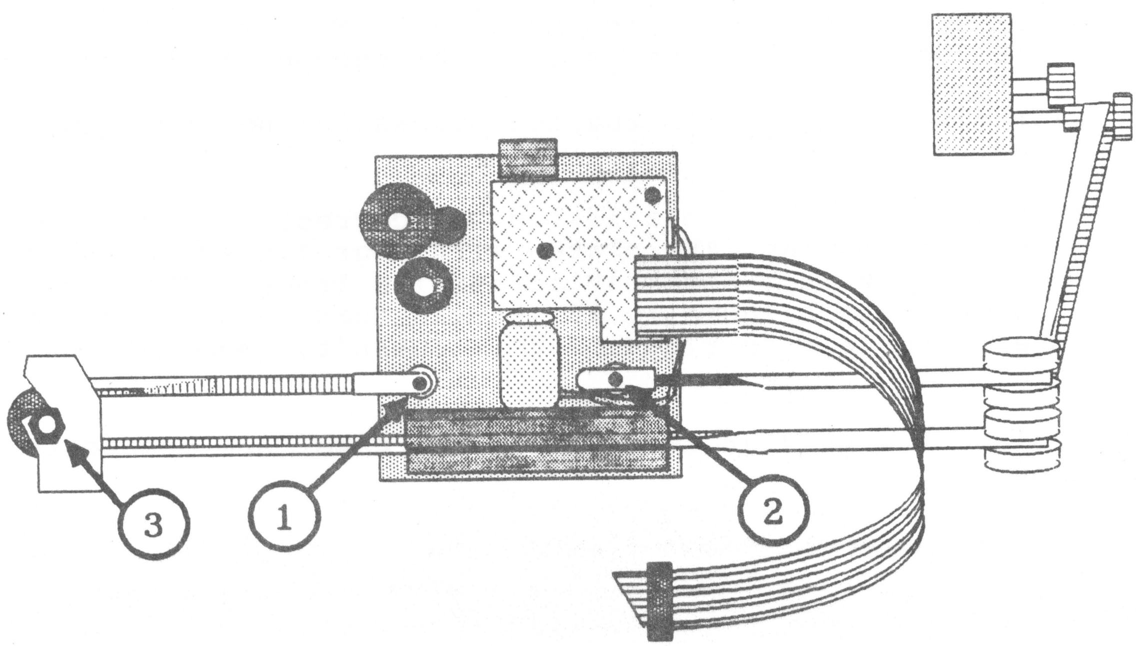


Figure 4

apple computer

REPLACING THE DRIVE BELT

Required Tools: Medium Phillips screwdriver
5.5 mm nut driver or wrench, or
small adjustable wrench

NOTE: This procedure is optional at Level 1. In any case, it should only be necessary if the belt is cut or otherwise damaged.

1. Remove the printer assembly from the case.
2. Loosen the drive belt as follows:
   a) Loosen the two screws that hold down the belt tension bracket (Figure 3, #1).
   b) Loosen the belt tension screw (Figure 3, #2) as far as possible without removing it.
3. Remove the front guide bar and ribbon drive wire (see **Replacing the Ribbon Drive Wire**, above.)
4. Remove the screws from the ends of the carriage shaft (Figure 3, #3).
5. Move the carriage assembly all the way to the left.
6. Lift the right end of the carriage shaft out of its socket. (You will have to push outward on the side plate. See Figure 3, #4.)
7. Slide the carriage shaft out from the carriage assembly and completely out of the machine.
8. Slide the carriage assembly to the middle of its track.
9. Remove the two clear plastic paper guides and the print head. (To remove them, pull up with a wiggling motion.)
10. Lift the near edge of the carriage assembly up and rest the assembly on its print-head side, so that its underside is facing you. (See Figure 4 for a view of the underside of the carriage assembly.)
11. Remove the screws from the two ends of the belt (Figure 4, #1 and 2).
12. Loosen the nut on the left-hand belt pulley (Figure 4, #3); then pull the pulley out of its holder and remove the belt. **IMPORTANT:** Be careful not to lose the pulley's washers.

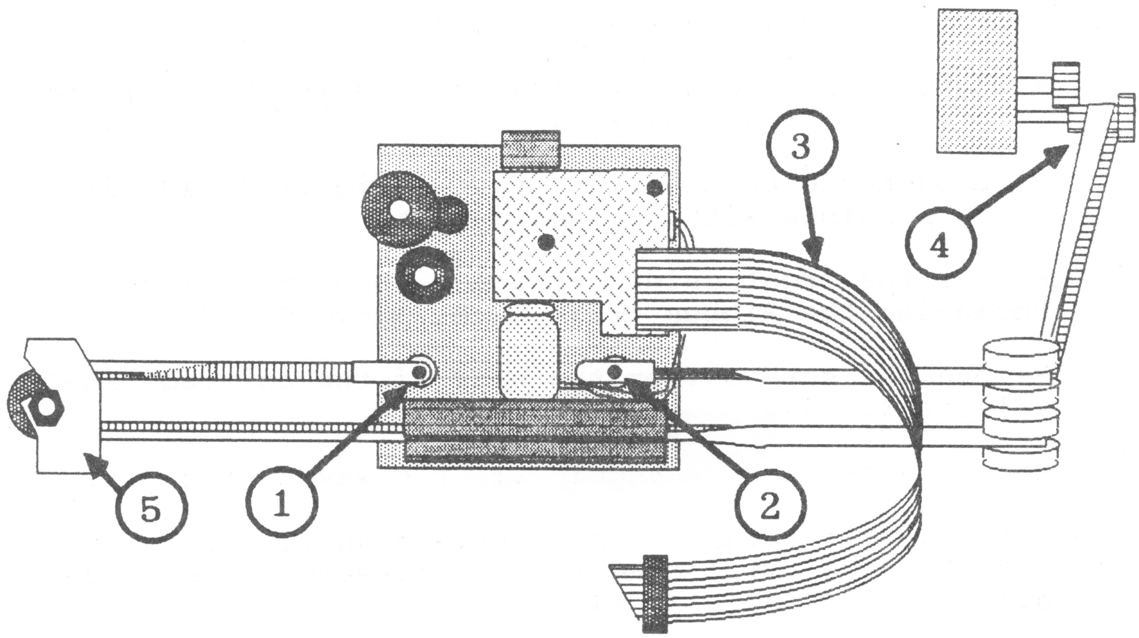


Figure 5

apple computer

Installing the New Belt

1. Attach either end-piece of the new drive belt to the right-hand mounting hole in the carriage assembly (Figure 5, #2) as follows:

   a) Hold the belt so that the smooth side faces up.

   b) Align the hole near the **midpoint** of the belt end-piece with the right-hand mounting hole in the carriage assembly (see Figure 5, #2).

   c) Insert and tighten the screw, being careful not to pinch any wires.

2. Route the belt as in Figure 5:

   - behind the wide plastic cable (Figure 5, #3);

   - over the upper pulley on the right side (give the belt one 90° turn so that the ridges on the belt engage the ridges on the pulley);

   - around the carriage drive pulley (Figure 5, #4);

   - back over the lower right-hand pulley;

   - under the carriage assembly (with ridged side up);

   - and through the left hand pulley bracket (Figure 5, #5) (from which you removed the pulley).

3. Replace the left-hand pulley in its slot. The small washers on each side go **inside** the slot. The large washer goes on the outside at the front, under the nut. **IMPORTANT:** Do not overtighten the nut. If you do, it may cause a home position error.

4. Route the loose end of the belt around the pulley, and line up the end-piece of the belt with the left hand mounting hole on the carriage assembly (see Figure 5, #1). (You will have to turn the belt 90° so that the ridges on the belt face toward you and the hole at the **end** of the end-piece lines up with the mounting hole.)

5. Attach the end-piece to the carriage assembly.

6. Turn the carriage assembly right side up and move it all the way to the left.

7. Put the carriage shaft back through the carriage assembly. (The small rubber bumper goes to the right side.)

8. Fit the carriage shaft into its sockets and replace the two screws that hold it in place.

9. Replace the ribbon drive wire and front guide bar (see above).

10. Replace the print head (including the rubber cap on its connector) and the plastic paper guides.

11. Adjust the drive belt tension (see Section 3, **Adjustments**).

12. Move the carriage assembly back and forth along its track, observing to make sure that it is correctly installed.

Apple Color Plotter

APPLE COLOR PLOTTER TECHNICAL PROCEDURES

TABLE OF CONTENTS

Section 1. Troubleshooting

Section 2. Setup and Configuration

Section 3. Take-apart

Section 3. Take-apart (continued)

Section 4. Illustrated Parts List

apple computer

Apple Color Plotter Technical Procedures

Section 1

Troubleshooting

Contents:

For these procedures you will need:

- Plotter test diskette
- Medium phillips screwdriver
- Medium flatblade screwdriver
- Allen wrench
- 5.5 mm nutdriver
- Tape

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Introduction

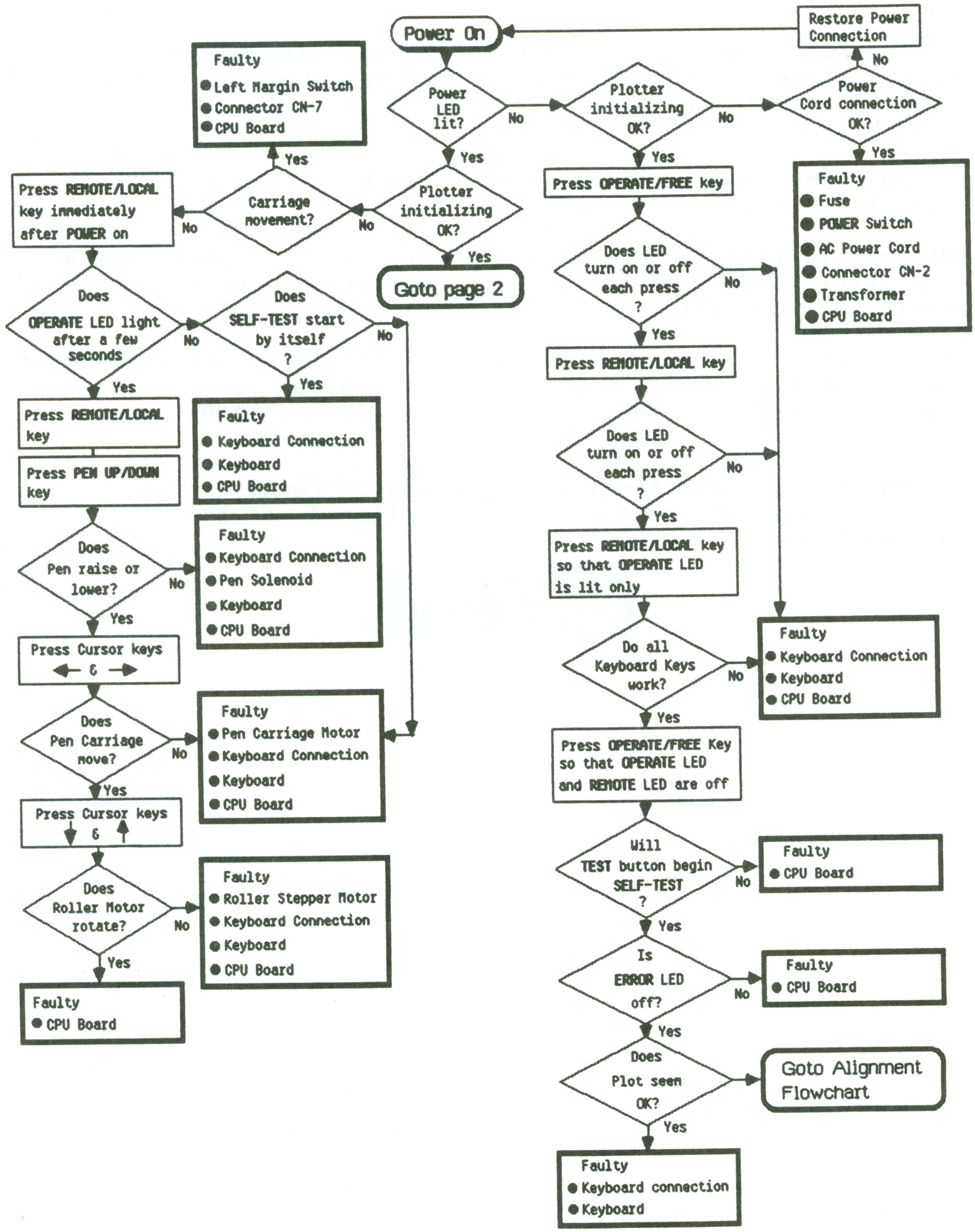
The troubleshooting flowchart is largely self explanatory. Refer to the take-apart section of these procedures if you need instruction on how to remove, replace, and adjust modules.

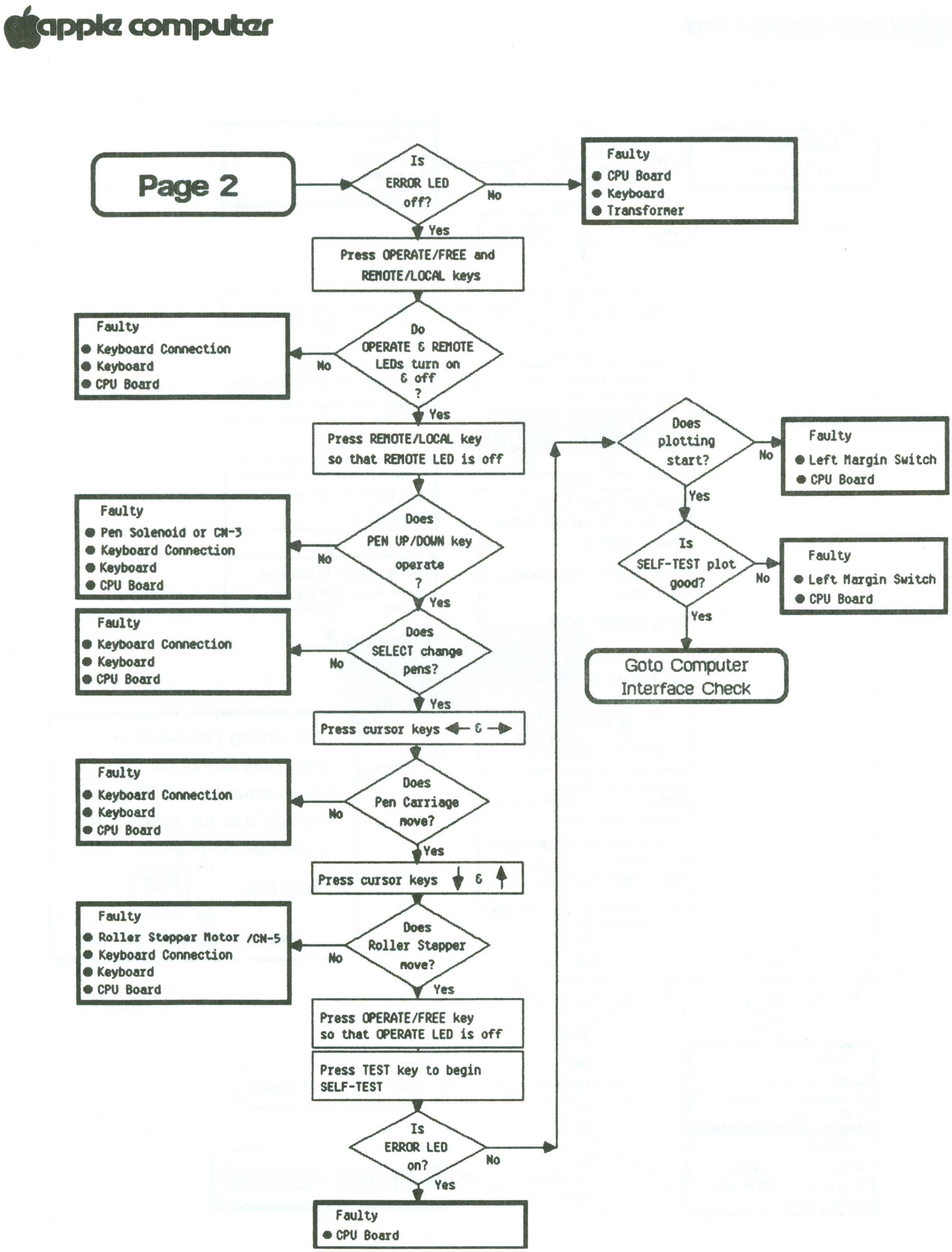
A few terms that are used in the flowchart may need clarification.

Plotter Initialization - After powering-up the plotter, the pen carriage travels to the left and rotates several times until pen number 1 is pointing down.

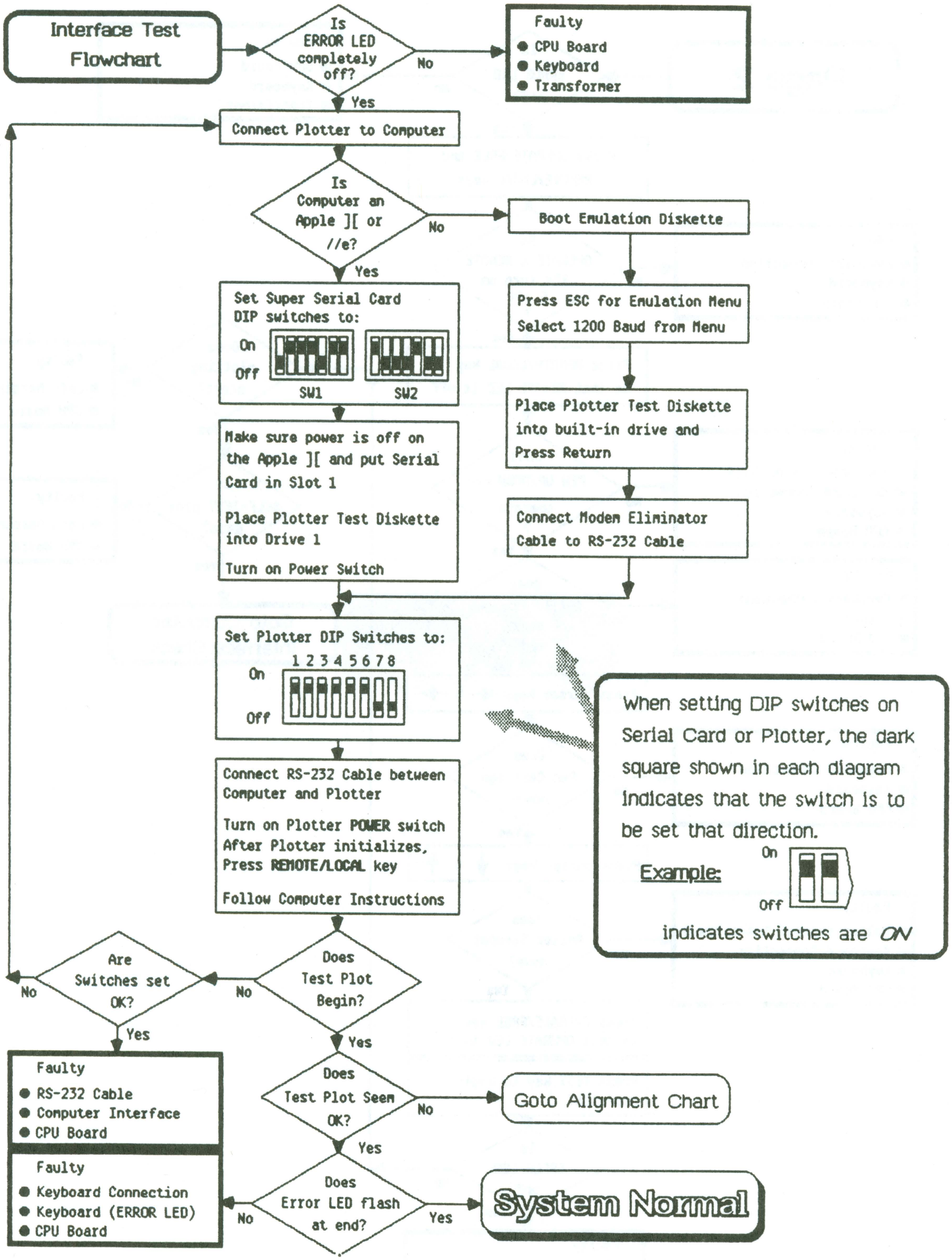
Self-Test - After power-up and initialization, press the test button on the plotter keyboard. The plotter is reinitialized, and then draws a self-test pattern.

Names of parts and their location can be found in the Exploded Diagram and Parts List (Section 4 of these procedures).

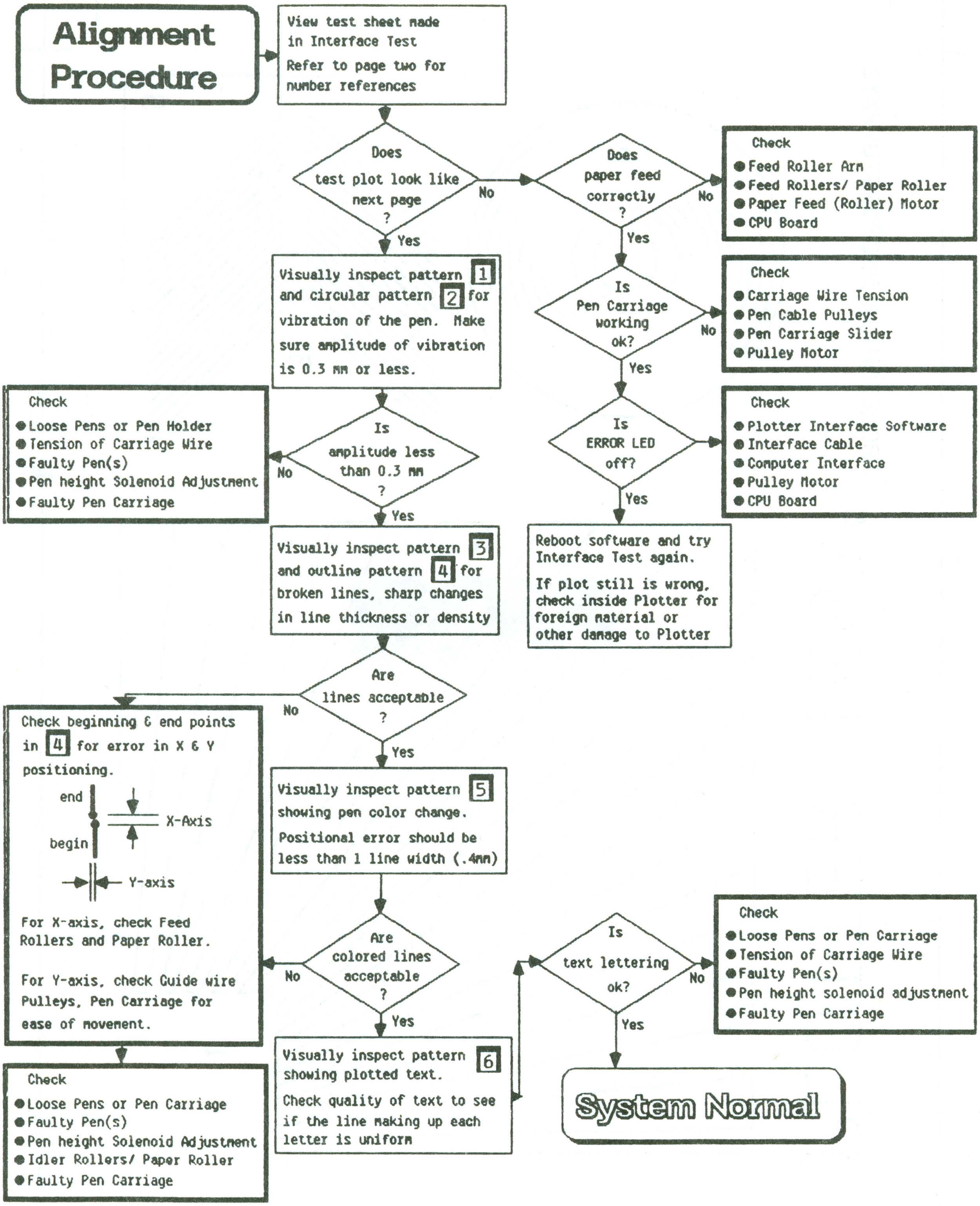

Power On
Restore Power Connection
Power LED lit?
Plotter initializing OK?
Power Cord connection OK?
Faulty
Left Margin Switch
Connector CN-7
CPU Board
Faulty
Fuse
POWER Switch
AC Power Cord
Connector CN-2
Transformer
CPU Board
Press REMOTE/LOCAL key immediately after POWER on
Carriage movement?
Plotter initializing OK?
Press OPERATE/FREE key
Goto page 2
Does LED turn on or off each press ?
Does OPERATE LED light after a few seconds
Does SELF-TEST start by itself ?
Press REMOTE/LOCAL key
Press REMOTE/LOCAL key
Faulty
Keyboard Connection
Keyboard
CPU Board
Press PEN UP/DOWN key
Does LED turn on or off each press ?
Press REMOTE/LOCAL key so that OPERATE LED is lit only
Does Pen raise or lower?
Faulty
Keyboard Connection
Pen Solenoid
Keyboard
CPU Board
Press Cursor keys ← & →
Do all Keyboard Keys work?
Faulty
Keyboard Connection
Keyboard
CPU Board
Does Pen Carriage move?
Faulty
Pen Carriage Motor
Keyboard Connection
Keyboard
CPU Board
Press OPERATE/FREE Key so that OPERATE LED and REMOTE LED are off
Press Cursor keys ↓ & ↑
Will TEST button begin SELF-TEST ?
Faulty
CPU Board
Does Roller Motor rotate?
Faulty
Roller Stepper Motor
Keyboard Connection
Keyboard
CPU Board
Is ERROR LED off?
Faulty
CPU Board
Faulty
CPU Board
Does Plot seem OK?
Goto Alignment Flowchart
Faulty
Keyboard connection
Keyboard
Yes
No


apple computer
Page 2
Is ERROR LED off?
No
Faulty
● CPU Board
● Keyboard
● Transformer
Yes
Press OPERATE/FREE and REMOTE/LOCAL keys
Do OPERATE & REMOTE LEDs turn on & off ?
No
Faulty
● Keyboard Connection
● Keyboard
● CPU Board
Yes
Press REMOTE/LOCAL key so that REMOTE LED is off
Does PEN UP/DOWN key operate ?
No
Faulty
● Pen Solenoid or CN-3
● Keyboard Connection
● Keyboard
● CPU Board
Yes
Does SELECT change pens?
No
Faulty
● Keyboard Connection
● Keyboard
● CPU Board
Yes
Press cursor keys ← & →
Does Pen Carriage move?
No
Faulty
● Keyboard Connection
● Keyboard
● CPU Board
Yes
Press cursor keys ↓ & ↑
Does Roller Stepper move?
No
Faulty
● Roller Stepper Motor /CN-5
● Keyboard Connection
● Keyboard
● CPU Board
Yes
Press OPERATE/FREE key so that OPERATE LED is off
Press TEST key to begin SELF-TEST
Is ERROR LED on?
No
Yes
Faulty
● CPU Board
Does plotting start?
No
Faulty
● Left Margin Switch
● CPU Board
Yes
Is SELF-TEST plot good?
No
Faulty
● Left Margin Switch
● CPU Board
Yes
Goto Computer Interface Check

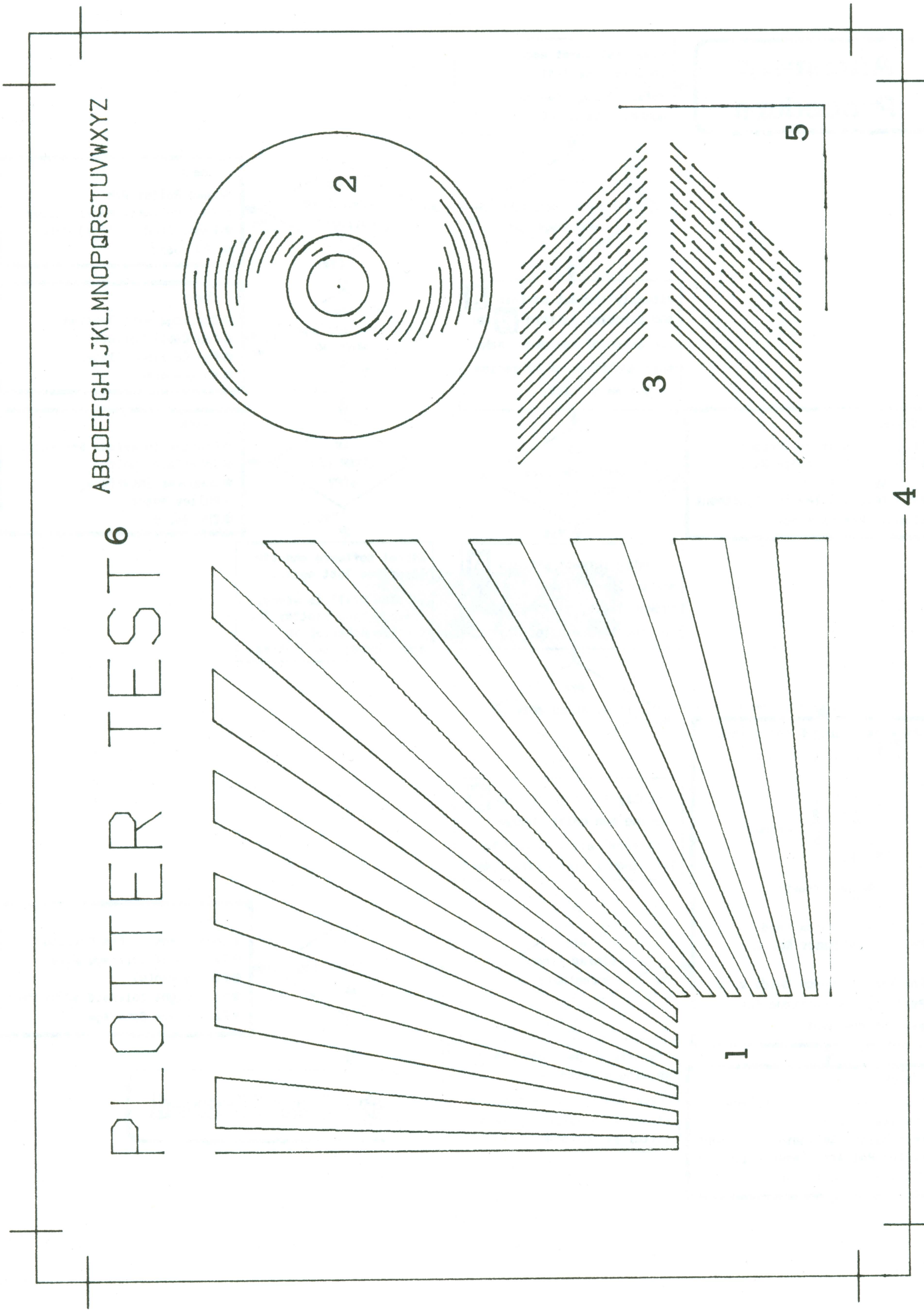
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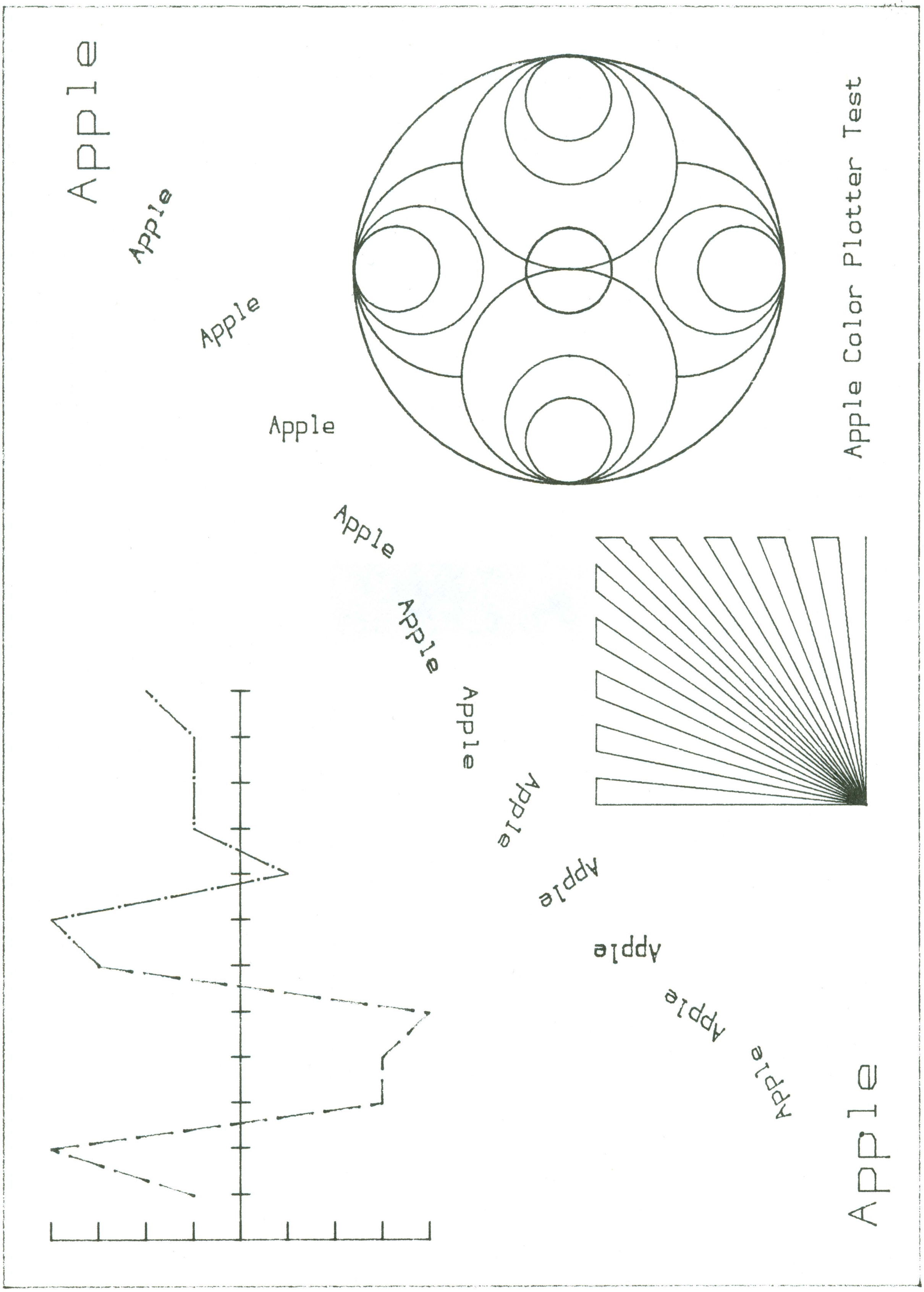


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Apple Color Plotter Test
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Apple Color Plotter

Section 2

Setup and Configuration

Contents:

For these procedures you will need:

- Apple Color Plotter
- Apple computer with monitor and power cable
  - If you are attaching an Apple //e,][+, or][you will need a serial port card
  - If you are attaching an Apple /// you will need an Apple][Emulation diskette
- Apple Color Plotter test diskette
- Plotter power cable
- RS232 cable
- Modem eliminator cable
- Small flatblade screwdriver

Introduction

Refer to Section 4, Exploded Diagram and Parts List, if you need assistance locating the parts referred to below.

There are a few things you must remember to do when you are setting up the plotter for a customer.

1. Use the modem eliminator cable as well as the RS232 cable to connect the plotter to an Apple.

2. Verify the setting of the plotter DIP switches. (Although the User's Guide says the plotter will be shipped with the switches set correctly, it is possible that they will not be correct.)

3. Boot the plotter test diskette to see that the computer communicates successfully with the plotter.

Below you will find brief instructions outlining these procedures.

Beware: The Apple /// and the Apple][computers have slightly different procedures. Be sure to read the notes (in each section below) which describe these differences.

Hooking up the Plotter

1. Connect the "female" end of the modem eliminator cable (the shorter of the two cables you received with the color plotter) to one of the ends of the RS232 cable.

2. Tighten the screws that come with the cables to secure the connection.

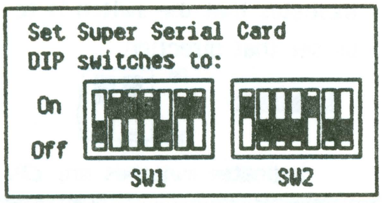
3. Connect one end (it does not matter which) of the cable you just "made" to the plotter. Secure the connection by tightening the mounting screws.

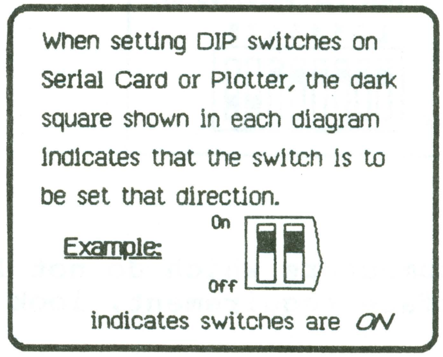
4. Connect the other end of the cable to the computer.

   Note: Apple /// - Attach it to port C.

   Note: Apple][,][+, //e - Attach it to a super-serial card with DIP switches set as seen below (See Figure 1).

FIGURE 1





4. Connect the power cable to the plotter.

5. Plug the power cable into an AC outlet.

Setting the DIP switches

The plotter is capable of communicating with a large number of computers. Within the RS232 standard there are variations of signal format and transmission speed, to suit different machine-to-machine communication requirements. The interface setting switches allow you to define the RS232 input.

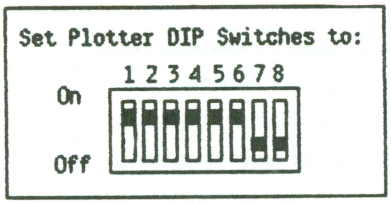
The interface setting switches are on the back panel of the plotter.

Apple Computers communicate with the plotter via an RS232 interface that is configured as follows:

- 7 bits
- No parity selected
- 2 stop bits
- 1200 baud

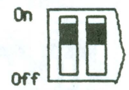
Generally the settings for the plotter, when communicating with an Apple, should be as shown in Figure 2, below.

FIGURE 2



When setting DIP switches on Serial Card or Plotter, the dark square shown in each diagram indicates that the switch is to be set that direction.

Example:



indicates switches are *ON*

For computers which do not follow this particular RS232 interface requirement, look at the table below. (See Figure 3.)

FIGURE 3

Plotter Interface DIP Switch Settings

1	2	3	4	5	6	7	8	Setting
					OFF	OFF	OFF	75 BAUD
					OFF	OFF	ON	150 BAUD
					OFF	ON	OFF	300 BAUD
					OFF	ON	ON	600 BAUD
					ON	OFF	OFF	1200 BAUD
					ON	OFF	ON	2400 BAUD
					ON	ON	OFF	4800 BAUD
					ON	ON	ON	9600 BAUD
			OFF	OFF				2 STOP BITS
			ON	OFF				1.5 STOP BITS
			OFF	ON				1 STOP BIT
			ON	ON				INVALID
		OFF						EVEN PARITY
		ON						ODD PARITY
	OFF							PARITY
	ON							NO PARITY
OFF								8 BITS
ON								7 BITS

Load Pens

Please note: If these instructions are not sufficient, a more detailed explanation can be found in the "Pens and Paper" chapter in the User's Guide.

1. Remove the pen holder from the pen carriage by pulling it towards you by the light colored plastic.

2. The pen holder has the numbers 1 through 4 on the front. Load the holder with the following pen/number combinations: black/1; red/2; green/3; blue/4.

3. Install the holder in the pen carriage. (Slide the pen holder onto the hub of the (black) carriage head until it snaps into place.)

   NOTE: The holder will only fit one way.

Load Paper

Please note: If these instructions are not sufficient, more detailed explanations can be found in the "Pens and Paper" chapter in the User's Guide.

Set paper width

1. Push pen carriage to the left.

2. Pull the light colored arm of the right feed roller horizontally toward you and slide the feed roller mechanism sideways to the right as far as it will go.

3. Slide a piece of 8 1/2 by 11 inch paper lengthwise on the front deck of the plotter in the position to be fed in, with its left edge about 6 mm (1/4") from the left wall of the plotter.

4. Pull the light colored arm of the right feed roller horizontally toward you and slide the feed roller mechanism sideways to the left until it is well over the right edge of the paper. The paper should not run into the arm itself.

5. Release the arm, then move the arm and feed roller to the right a short distance until it clicks into a notch.

   Note: The feed roller will not drop down enough to grip the paper until it clicks into a notch.

Insert paper

6. Slide a sheet of paper under the metal tabs until it will go no further. Make the paper align with the line at the left of the paper table, marked "paper side."

7. Depress the paper feed knob on the right of the plotter, and turn it clockwise. You may have to push the paper a bit before it catches.

   Paper is properly inserted when the top edge reaches the marks half way up the paper table.

   If the paper is not properly aligned (straight), remove it and try again.

Testing Computer/Plotter Communication

For the Apple ///

1. Turn on the plotter.

2. Press LOCAL on the plotter keyboard.

3. Boot the Apple][Emulation diskette.

4. Insert plotter test diskette.

5. Press RETURN. (Continue at Testing the Plotter)

For the Apple][,][+, and //e

1. Boot the plotter test diskette in disk drive 1.

Testing the plotter

Just follow the instructions on the screen.

That is:

- Load the paper into the plotter. (The "size A" on the screen refers to an "A" on the plotter table, which indicates the width of the paper.)

- Press RETURN.

The plotter should now draw a test pattern. See Figure 4, on the following page, for an example.

FIGURE 4



Apple Color Plotter Technical Procedures

Section 3

Take-apart

Contents:

apple computer

APPLE COLOR PLOTTER TAKE-APART

Introduction

These procedures are constructed so you can find the replacement or adjustment you are interested in by using the table of contents as a reference guide.

Since there is no formal training on this product, go through this entire procedure if you have not done so previously. It is probably not necessary for you to practice the soldering in the removal and replacement of the ON-OFF switch.

Be sure to:

- follow the removal procedures in the order in which they are presented. Then reassemble the plotter, in the reverse order.
- perform the adjustments when they are referred to in the replacement sections (i.e., do the solenoid adjustment as part of replacing the solenoid, and do the carriage wire adjustment when replacing the pulley motor).
- perform the carriage wire replacement. The first time it can be very tricky!
- remove and replace both motors.

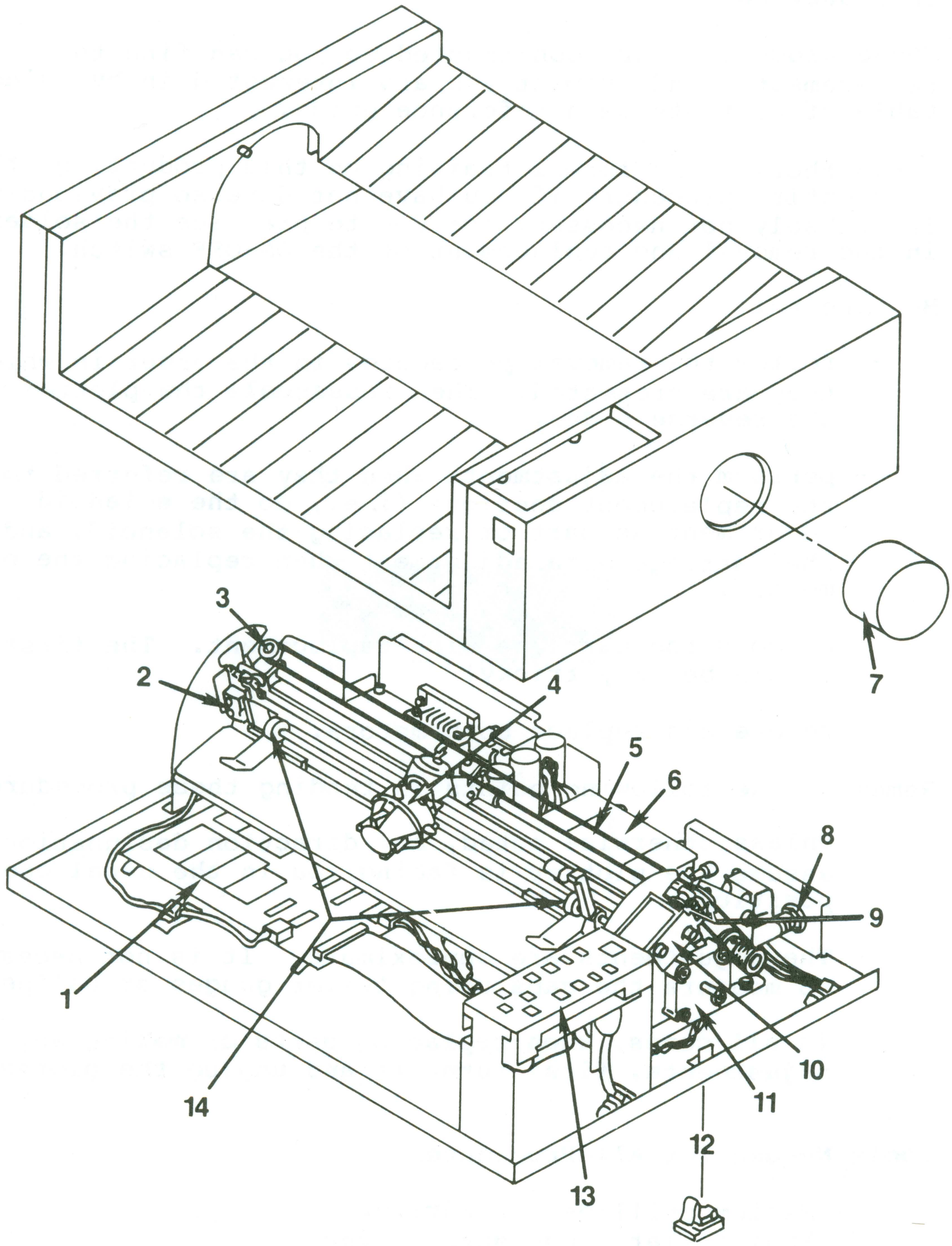
Remember the following points in reading these procedures:

- Unless otherwise noted, any direction designations assume the plotter is facing you in the usual operating position.
- The adjustments are approximate. It is not necessary to measure the gaps using feeler gauges or calipers.
- **In all cases, when replacing parts or making any of the adjustments, first turn off and unplug the plotter.**

Tools Needed for All Procedures

- Medium phillips screwdriver
- Medium flat blade screwdriver
- 1.5 mm allen wrench
- 5.5 mm nutdriver
- Needlenose pliers
- Tape

FIGURE 1



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Remove Cover

1. Unplug the plotter.

2. Remove the pens from the pen carriage.

3. Turn the plotter over and set it on its top, being careful that the plastic cover remains closed.

4. Remove the black tab (Figure 1, #12) from the bottom plate of the plotter. It is located on the left side of the plotter directly over the paper feed knob (Figure 1, #7). (Little raised arrows on the tab indicate which direction to push the tab before lifting it off.)

5. To remove the paper feed knob, loosen the two set screws on the knob shaft by inserting the allen wrench in the hole made by the removal of the black tab (Figure 1, #12). (Push knob in to turn shaft.) Pull the knob free.

6. Remove the four phillips head screws from the bottom plate.

7. Set the plotter on its feet.

8. Lift the cover free.

Replace Cover

First check that all five connectors are in place with the cables in the clamps. Check that the carriage wire is wound correctly and sitting in the pulley guides.

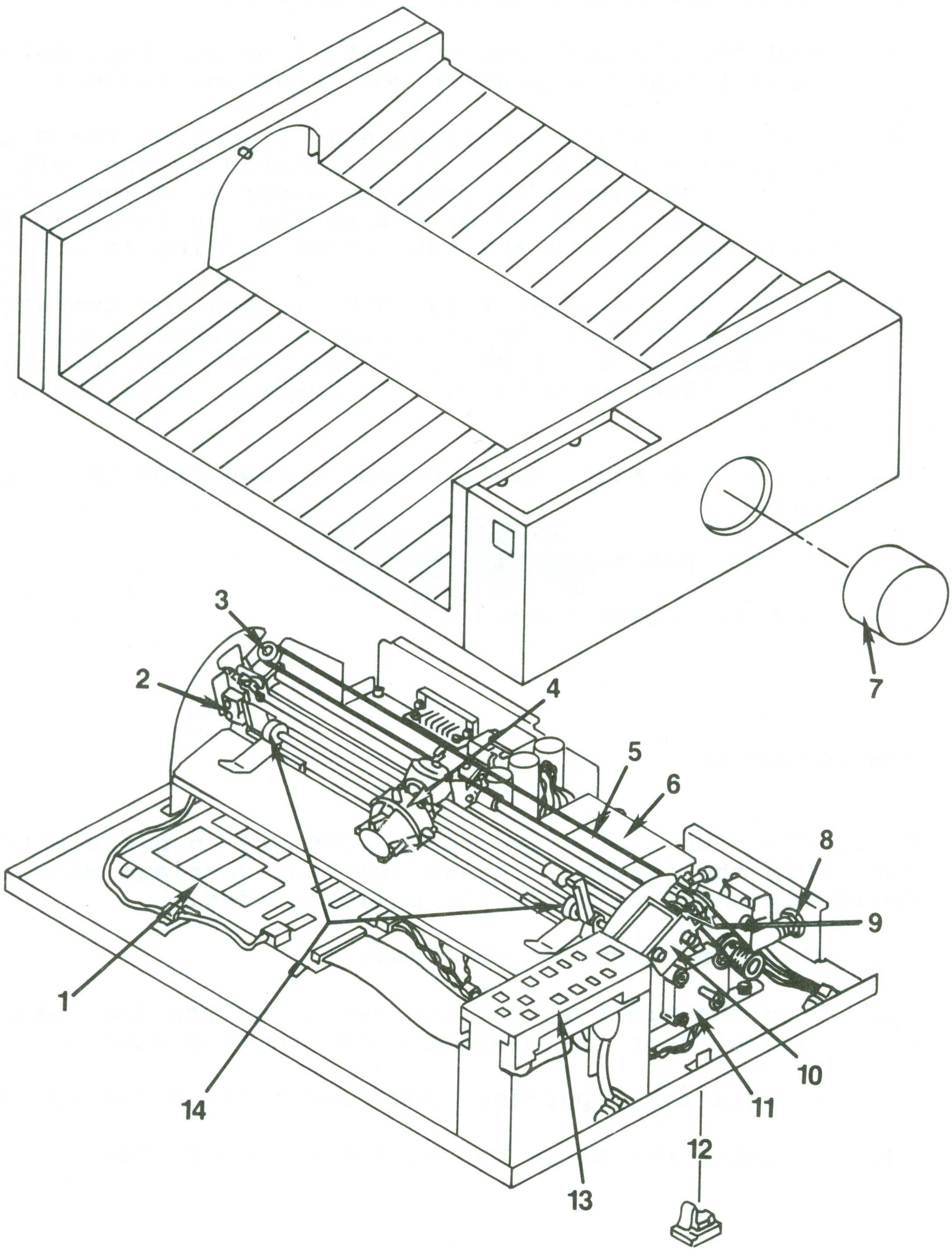
1. Place the cover on the base.

2. Turn the plotter over and set it on its top, being careful that the plastic cover remains closed.

3. Replace the paper-feed knob and tighten the set screws.

4. Reinsert the black tab on the bottom plate.

FIGURE 2



Remove Carriage/Bed Assembly

1. Remove cover.

2. Remove the four phillips head screws, two from either side of the carriage/bed assembly.

3. Disconnect the four cables (all except the transformer cable) from the main PC board and from the two routing clamps which hold the cables to the base. (To release the cables push down on the outside of the clamp and pull up on the body.) You may have to lift the carriage/bed assembly to access two of the connectors.

4. Remove the carriage/bed.

Replace Carriage/Bed Assembly

1. Set the carriage/bed assembly on the base.

2. Connect the cables to the PC board. (The two motor cables are connected to the PC board under the carriage/bed assembly. The rear motor is connected at CN4. The front motor is connected at CN5. The solenoid cable is fed under the carriage/bed assembly to CN3. The home position switch is connected at CN7.) Put the cables in the two clamps which hold the cables to the base.

3. Replace the four screws.

4. Replace the cover.

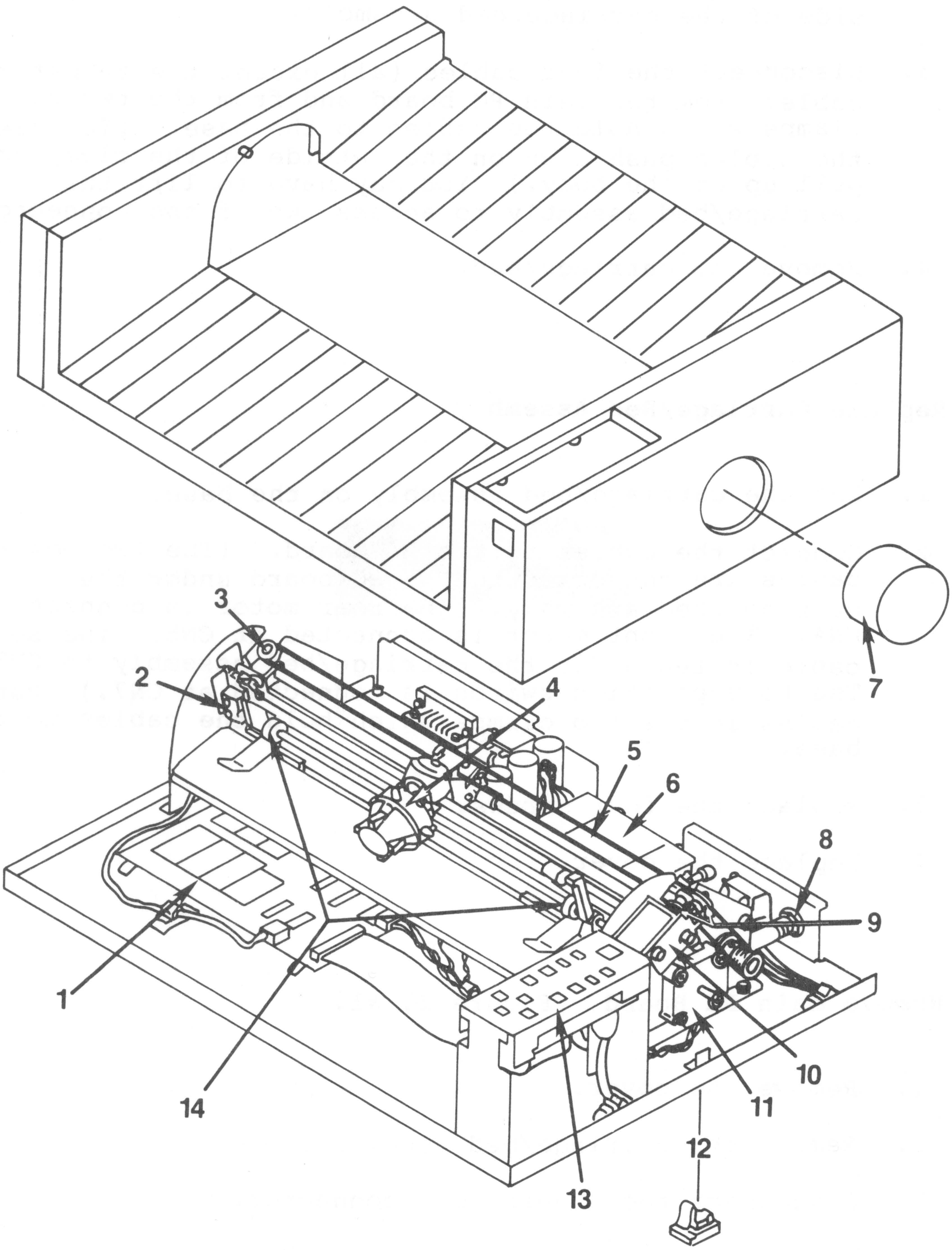
Remove Main PC Board - Figure 2, #1.

1. Remove the cover.

2. Remove the carriage/bed assembly.

3. Disconnect the transformer connector.

FIGURE 3



4. Disconnect the keyboard connector.

   Caution: The ribbon cable is attached by a strip connector. To remove the cable, grasp it as close to the connector as possible and pull to the right as you gently wriggle it out.

5. The PC board is attached to the base by four stand-offs and by two screws which are threaded through a bracket mounted to the back of the PC board.

   Remove the phillips screws on the far right and left sides of the PC board bracket. Push in the stand-offs and carefully lift the board from the base.

Replace Main PC Board

1. Place the PC board on the base and push down to engage the stand-offs.
2. Replace the screws.
3. Connect the transformer and keyboard connector.
4. Replace the carriage/bed assembly.
5. Replace the cover.

Remove Keyboard Assembly - Figure 3, #13.

1. Remove the cover.
2. Disconnect the ribbon cable from the main PC board.

   Caution: The ribbon cable is attached by a strip connector. To remove the cable, grasp it as close to the connector as possible and gently wriggle it out.

3. Remove the two phillips head screws which attach the keyboard assembly to the base.
4. Remove the ON/OFF switch wires from the routing clamps on the base.

5. Remove the ON/OFF switch from the keyboard assembly by removing the phillips head screw and lock washer.

Replace Keyboard Assembly

1. Place the ON/OFF switch in the new keyboard assembly. Screw in phillips head screw and lock washer to hold it in place.

2. Place the keyboard assembly on the bottom plate. Put the leads from the ON/OFF switch in the routing clamps. Tighten down the two sets of phillips head screws and lock washers.

3. Connect the ribbon cable to the main PC board.

4. Replace the cover.

Remove ON/OFF Switch

The ON/OFF switch is located on the keyboard assembly.

1. Remove the cover.

2. Disconnect the ON/OFF switch from keyboard by removing the phillips screw and lock washer from the back of the keyboard.

3. Carefully cut off the shrink tubing with an X-acto knife.

4. Use a soldering iron to remove the cables from the terminals.

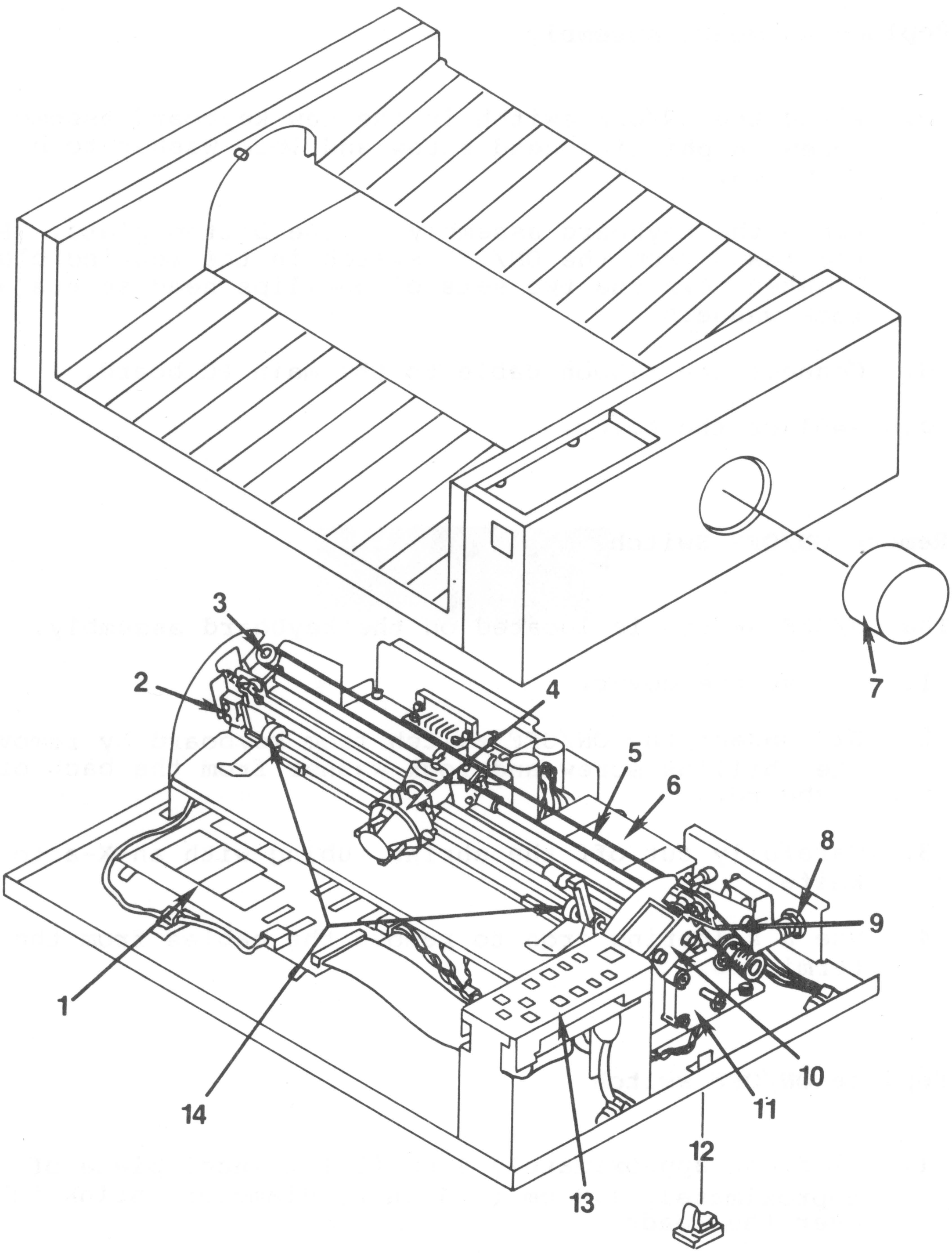
Replace ON/OFF switch

1. Slide an approximately 4 cm (1 1/2 inch) piece of approximately 1.8 cm (3/4 inch) diameter shrink tubing over the leads.

   WARNING: You must replace the shrink tubing to avoid the possibility of electric shock.

apple computer

FIGURE 4



2. Solder the leads to the switch. With the switch in the installed orientation, like-colored leads should be on the same side. The thicker leads should be attached to the center terminals. The thinner leads should be attached to the bottom terminals.

3. Slide the shrink tubing up over the terminals and heat it until snug.

4. Attach the ON/OFF switch to the keyboard assembly with the phillips head screw and lock washer.

5. Push switch in and out to be sure it works and is installed properly.

6. Replace the cover.

Remove Transformer - Figure 4, #6.

1. Remove the cover.

2. Remove the carriage/bed assembly.

3. Disconnect the transformer connector from the main PC board.

4. Remove the four screws that attach the transformer to the base plate.

5. Cut the cable-tie at the AC power socket.

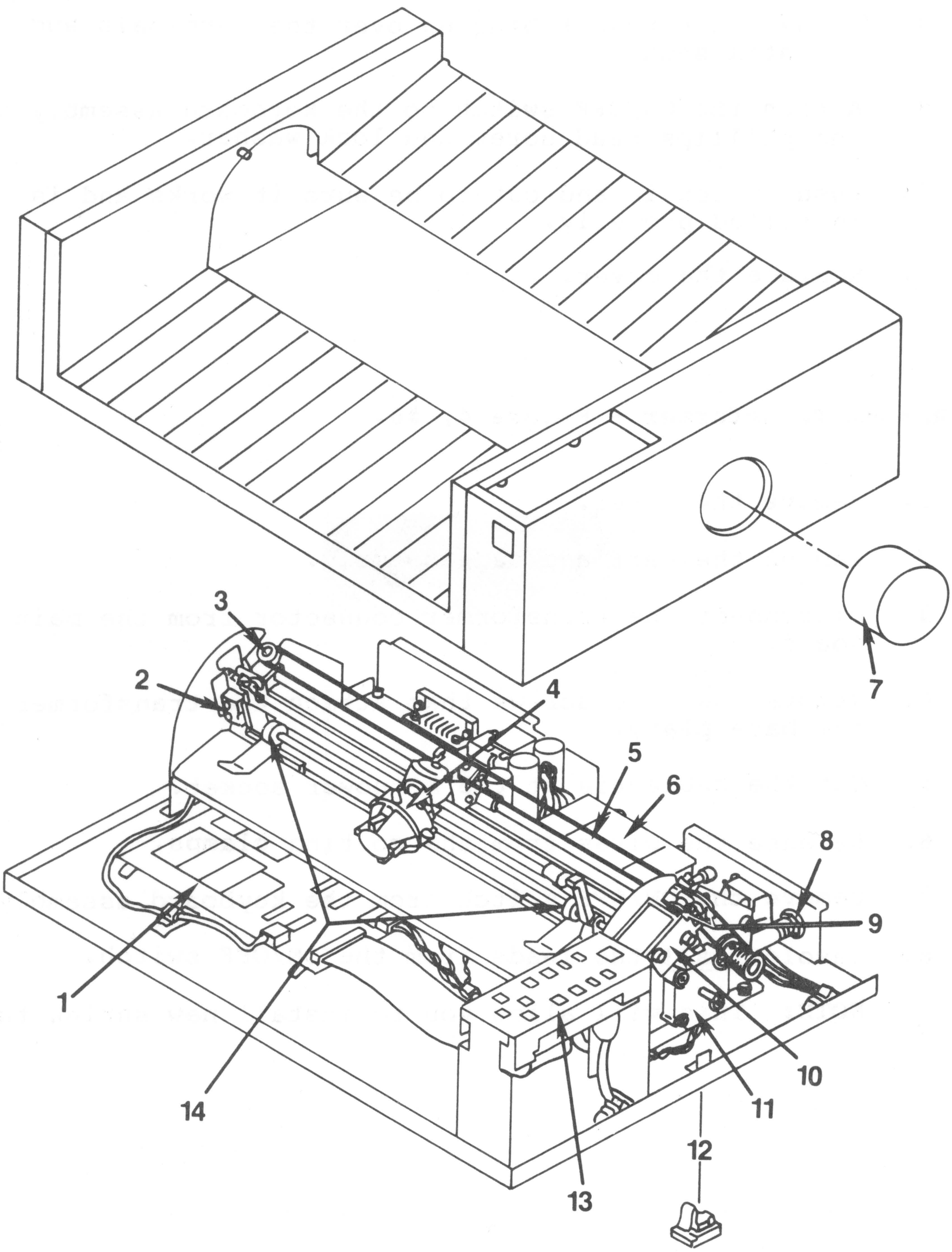
6. Release the wires from the routing clamps.

7. Remove the ON/OFF switch from the keyboard assembly.

8. Desolder <u>all</u> the leads from the ON/OFF switch.

   NOTE: This will allow you to install new shrink tubing.

FIGURE 5



Replace Transformer

1. Slide an approximately 4 cm (1 1/2 inch) piece of approximately 1.8 cm (3/4 inch) diameter shrink tubing over the ON/OFF switch leads.

   WARNING: You must replace the shrink tubing to prevent the possibility of electric shock.

2. Solder the leads to the switch. With the switch in the correct orientation, like-colored leads should be on the same side. The thicker leads should be attached to the center terminals. The thinner leads should be attached to the bottom terminals.

3. Slide the shrink tubing up and apply heat to shrink it.

4. Replace the ON/OFF switch.

5. Wind the leads from the ON/OFF switch through the routing clamps back toward the transformer. Lock the clamps.

6. Screw down the transformer.

7. Connect the transformer connector to the main PC board.

8. Gather the AC power wires and the transformer power wires into a cable-tie.

9. Replace the carriage/bed assembly.

10. Replace the cover.

Remove Paper Feed (Roller) Motor - Figure 5, #11.

This motor is the front motor on the right end of the carriage/bed assembly

1. Remove the cover.

2. Remove the carriage/bed assembly from the base.

3. Remove the nuts from the motor using a 5.5 mm nutdriver.

4. Pull the motor out. (The roller will come with it.)

FIGURE 6

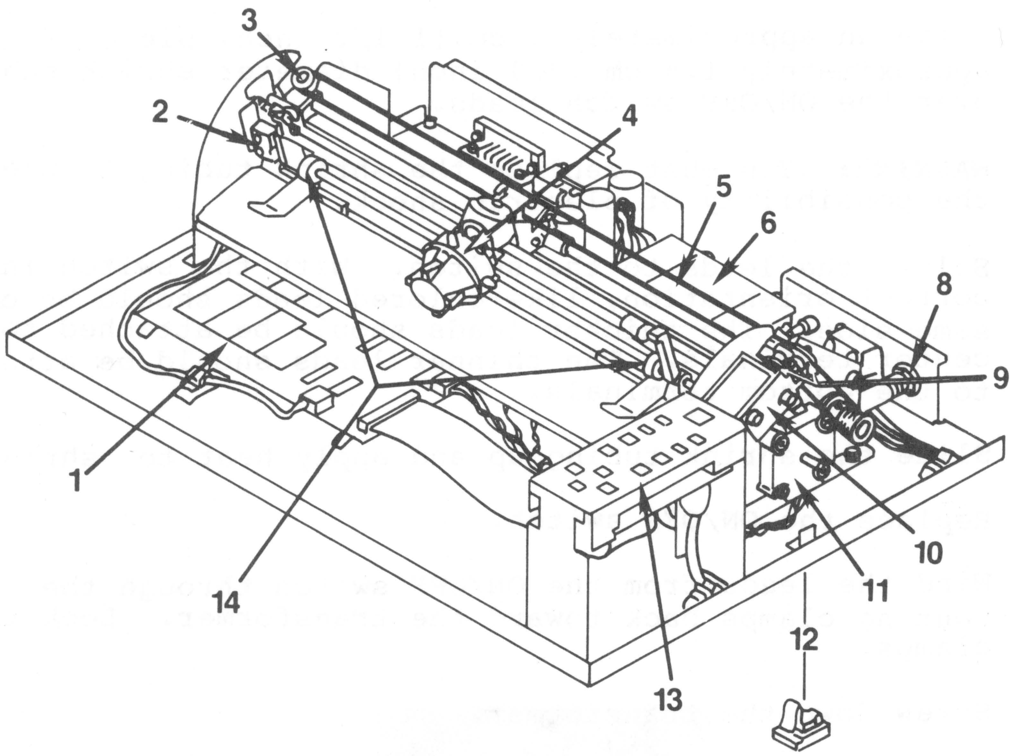
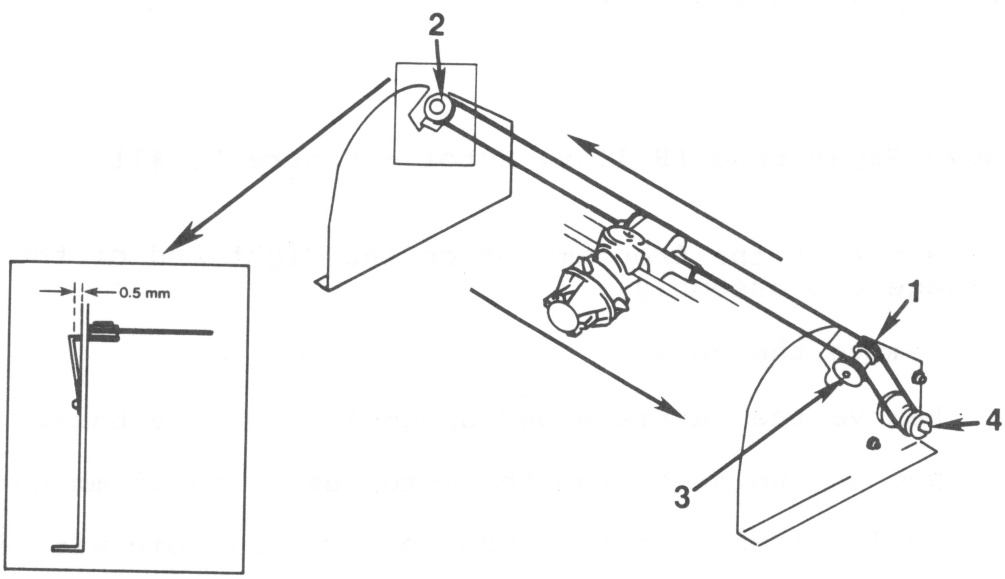


FIGURE 7



5. Use an allen wrench to loosen the set screws that attach the motor to the roller. Pull the roller and motor apart.

   Note: You may have to use a large flatblade screwdriver to separate them.

Replace Paper Feed (Roller) Motor

1. Place the new motor on the roller with a gap of approximately 1.5 mm (1/16 inch) between the roller and motor. Tighten the set screws.

2. Orient the motor so the wires exit downward.

3. Slide the roller and motor back into place. (The motor should fit snugly to the frame.) If you are having trouble, try the following:

   - Line up the motor mounting screws with the carriage bed assembly.

   - Depress the right feed roller arm and/or the left feed roller tab (Figure 6, #14) to give the roller more room to move.

   - Poke a small screwdriver through the hole in the left outside of the carriage/bed assembly to maneuver the end of the roller into place.

4. Replace the nuts, tightening alternately (the star washer goes with the top nut).

5. Replace the carriage/bed assembly.

6. Replace the cover.

Remove and Replace Left Pulley Assembly - Figure 6, #3.

The left pulley assembly attaches the left pulley to the carriage/bed assembly.

1. Put a piece of tape on the motor pulley (Figure 7, #4) so that the carriage wire will not unwind.

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FIGURE 8

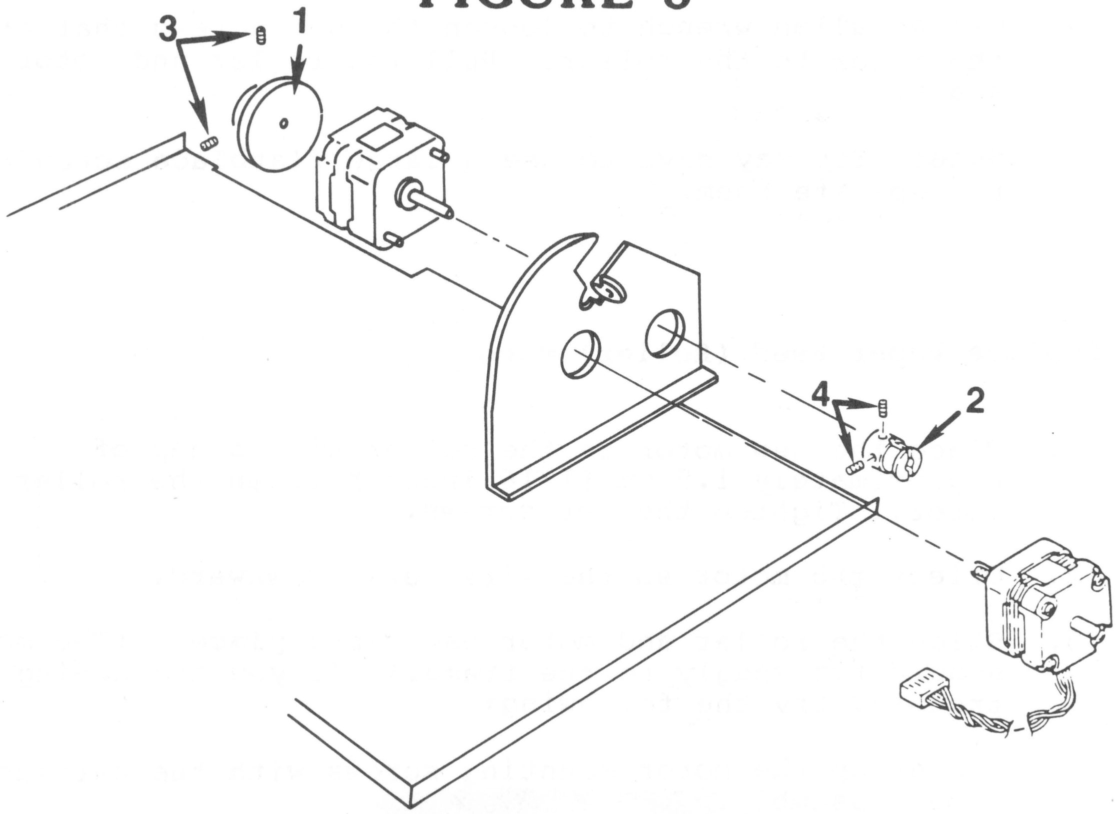
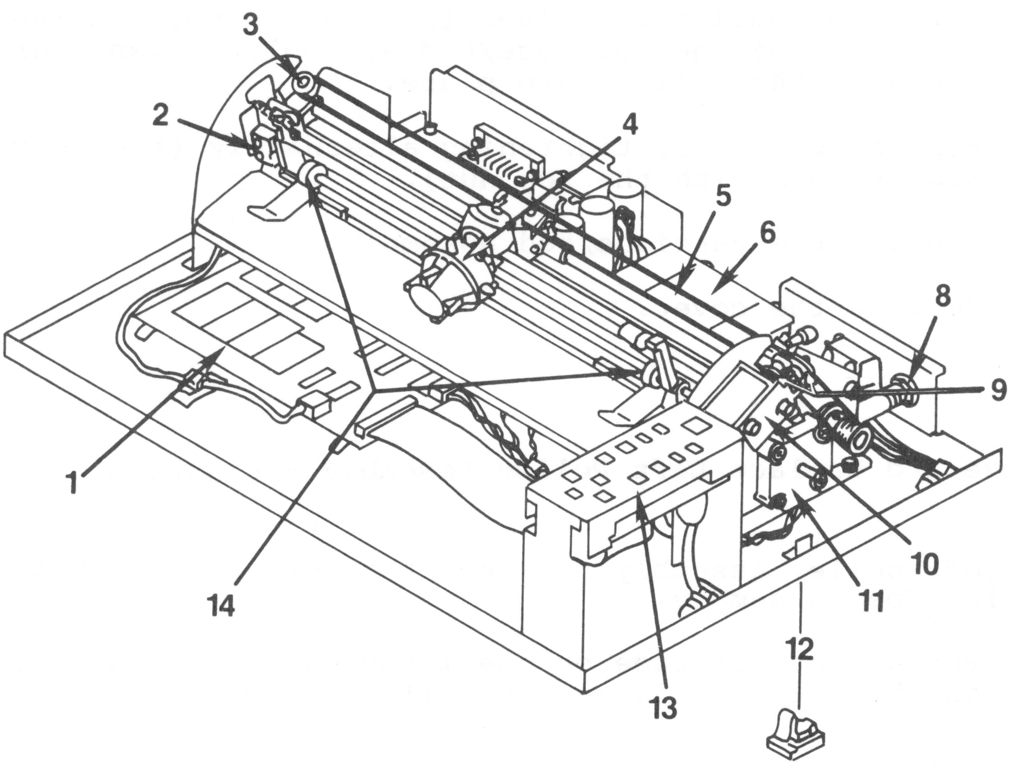


FIGURE 9



2. Remove and replace the left pulley assembly by removing and replacing the mounting screw on the bracket.

   NOTE: When in place, the pulley should be inside the frame of the carriage assembly. (See Figure 7, insert.)

3. Remove the tape from the motor pulley.

Remove Pulley Motor

This motor is the rear motor on the right end of the carriage/bed assembly.

1. To remove the flywheel (Figure 8, #1), rotate the motor pulley (Figure 8, #2) and flywheel so that the hole in the flywheel lines up with the set screws (Figure 8, #3) in the shaft. Loosen the two set screws.

2. Slide the flywheel off.

3. Slide the pen carriage (Figure 9, #4) to the middle of the carriage/bed assembly.

4. Loosen the retaining clamp screw (the easily visible phillips head screw on top of the pen carriage assembly that holds the carriage wire).

FIGURE 10

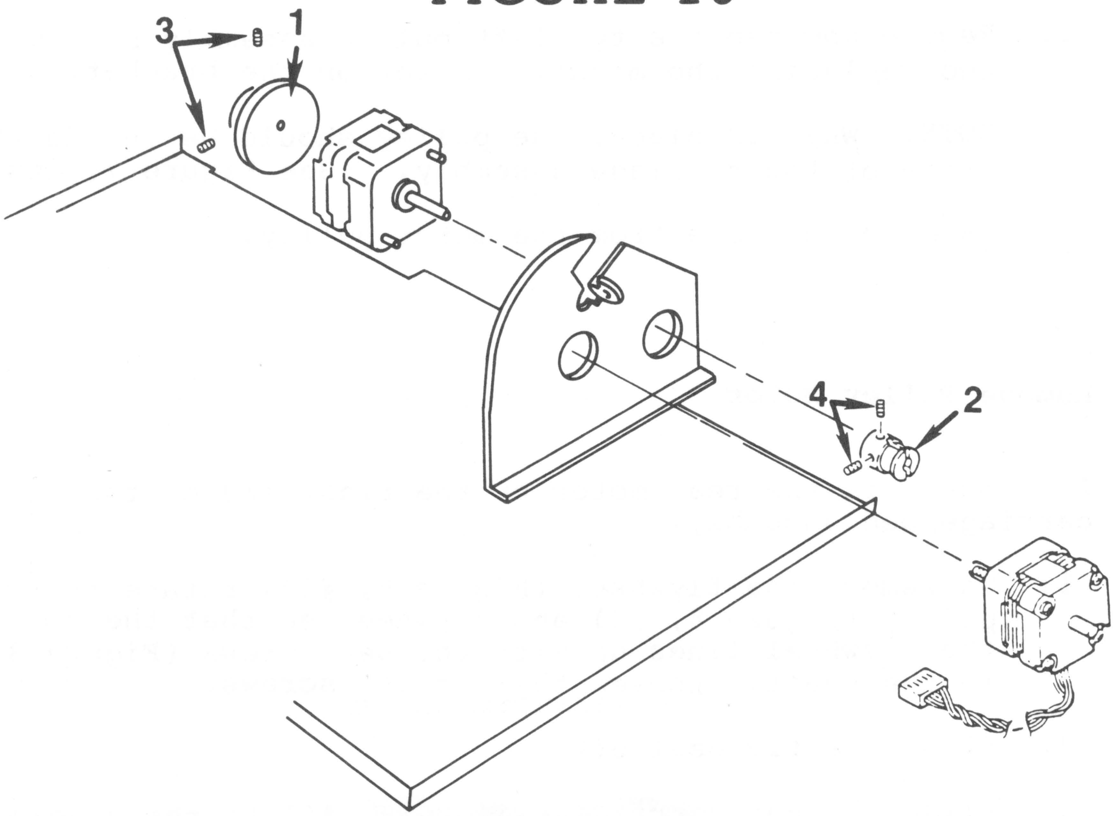
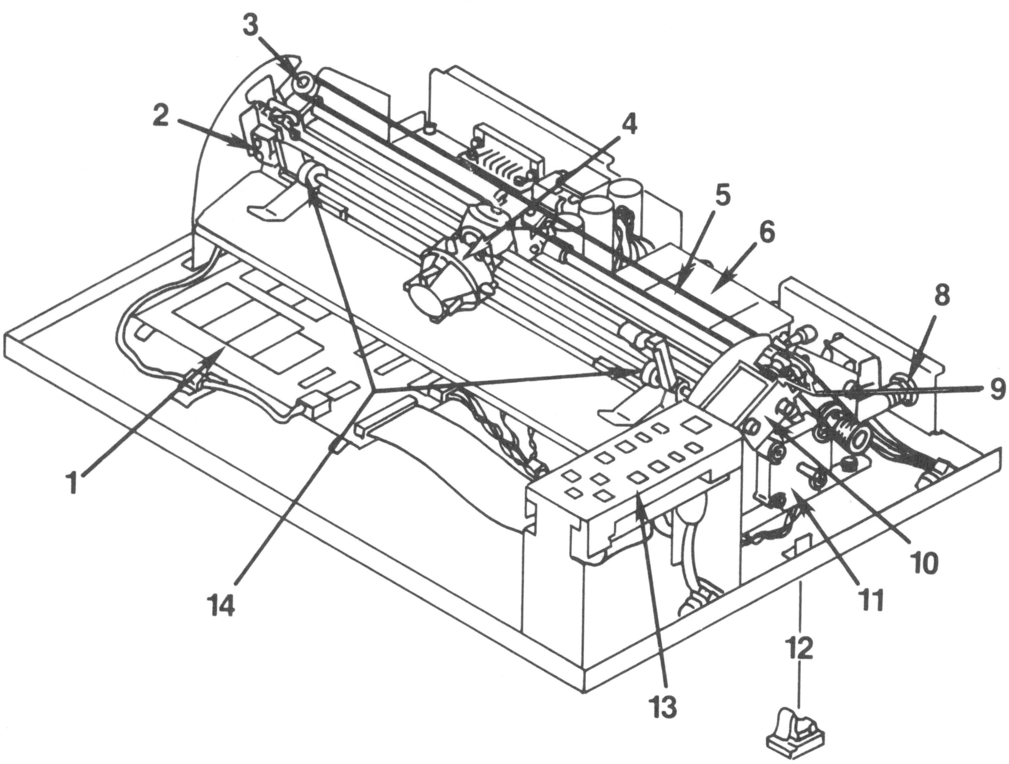


FIGURE II



5. Loosen the two set screws (Figure 10, #4) on the motor pulley.

6. To ensure the carriage wire does not unwrap during the following steps, put some tape around the wrapped wires on the motor pulley.

7. Release the carriage wire tension by loosening the nuts on the pulley motor.

8. To further release the carriage wire tension, loosen but do not remove the mounting screw for the left pulley assembly. (Figure 11, #3.)

9. Slide the wire off the left pulley assembly. Gently but firmly pull the pulley away from the pulley motor. (You may have to use a flatblade screwdriver to pry it loose.)

10. Remove the nuts from the screws that hold the motor in place.

11. Remove the motor.

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FIGURE 12

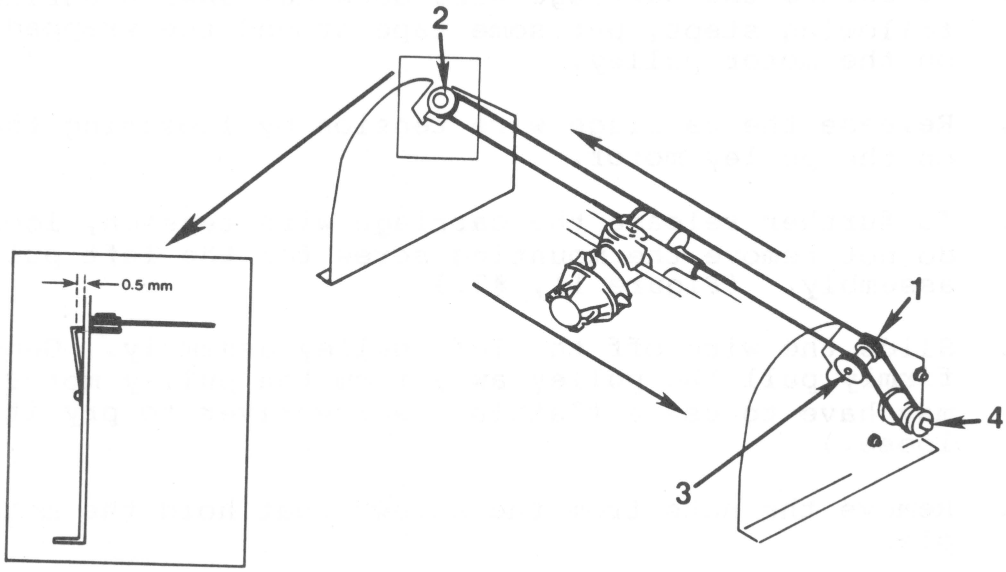
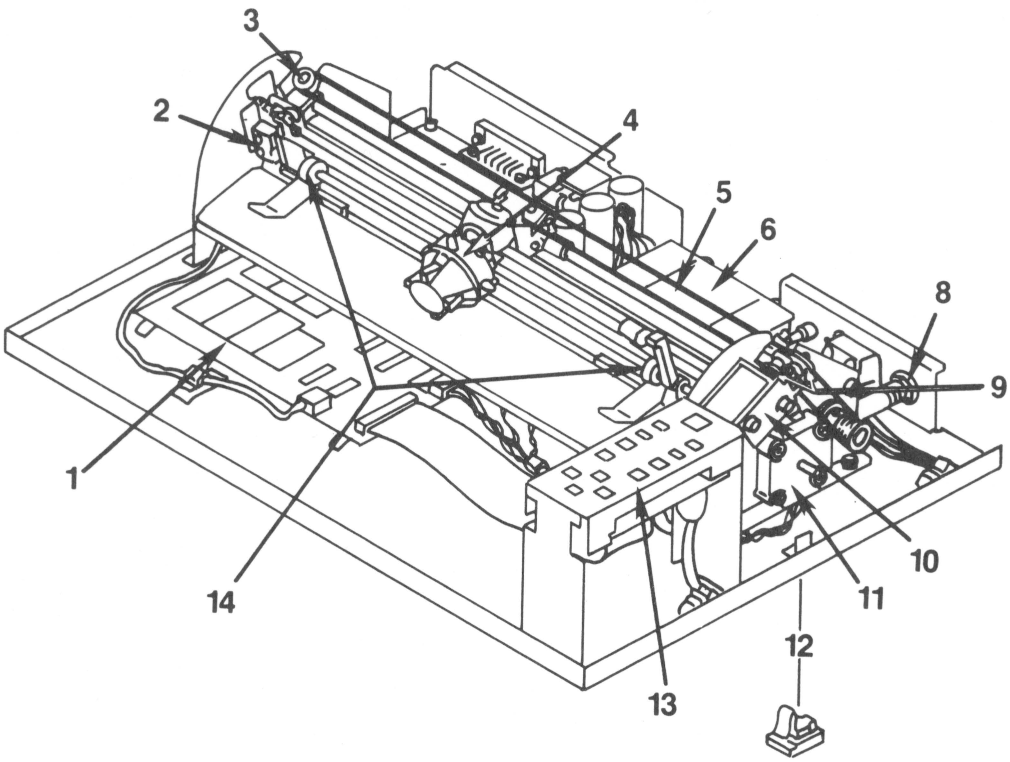


FIGURE 13



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Replace Pulley Motor

1. Put the motor into place (wires exiting downward).

2. Loosely replace the nuts for the motor (star washer belongs with top nut).

3. Slide the pulley back onto the motor. There should be an approximately 1.5 mm (1/16 inch) gap between the pulley and the side of the carriage/bed assembly.

4. Slide the carriage wire back over the left pulley. Ensure that the carriage wire is correctly mounted on the guide pulleys.

5. Remove the tape from the motor pulley and tighten down the set screws.

6. Tighten the left pulley-assembly mounting screw.

7. Turn the motor pulley until it has an equal number of turns on either side of where the carriage wire leaves the motor pulley.

8. Ensure that the pen carriage is in the middle of the carriage/bed assembly.

9. Place the carriage wire under the retaining clamp on the pen carriage. Tighten the retaining clamp screw.

10. Adjust the wire tension (see Carriage Wire Adjustment section) and tighten down motor pulley nuts.

11. Replace the flywheel. There should be an approximately 3 mm (1/8 inch) gap between the flywheel and the motor. Alternately tighten the set screws until they are completely tight.

Replace Carriage Wire - Figure 13, #5.

Replace the wire if it is kinked, worn, or otherwise damaged.

1. Cut or otherwise remove the old wire.

   NOTE: Treat the new wire gently. It kinks easily.

FIGURE 14

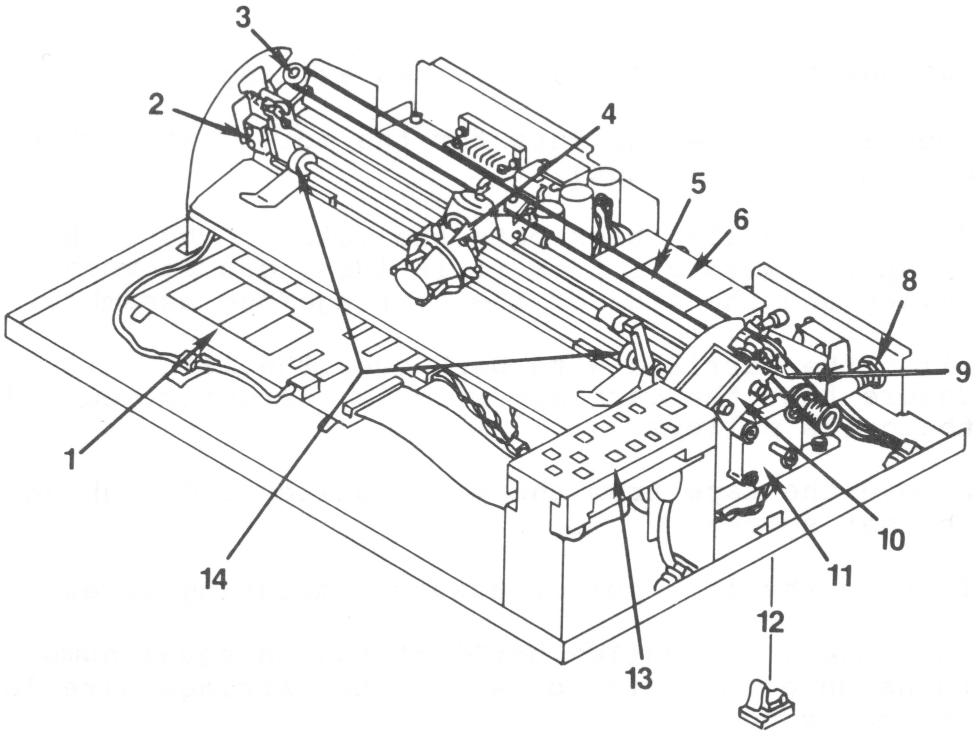
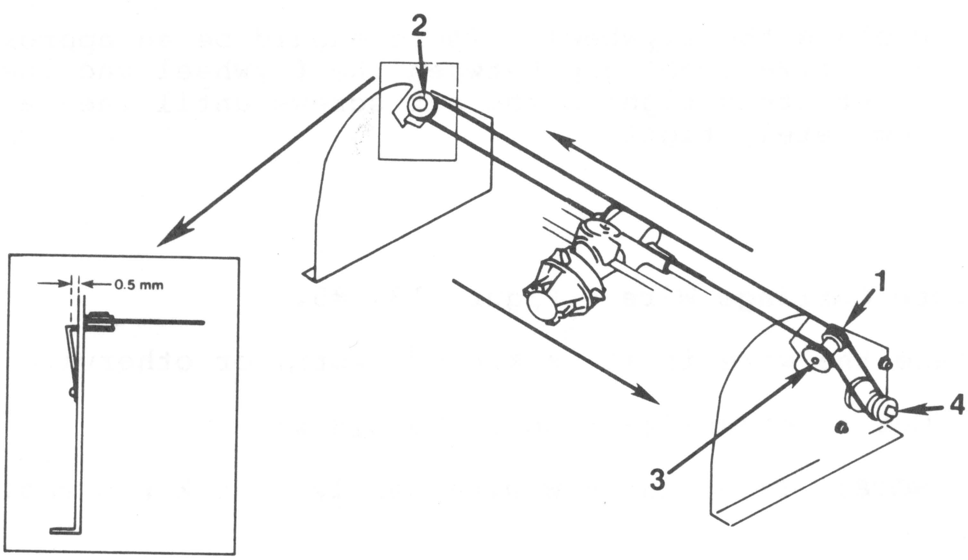


FIGURE 15



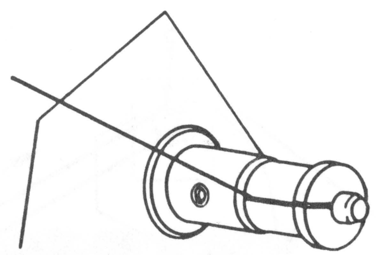
2. Loosen but do not remove the nuts on the pulley motor and the mounting screw for the left pulley assembly (Figure 14, #3).

3. Loosen the retaining clamp screw on the pen carriage (Figure 14, #4).

4. Tear off a piece of tape and leave it easily accessible.

5. There are two slots in the motor pulley (Figure 15, #4). Insert one end of the carriage wire into the long slot (Figure 16) and slide it to the inside (center) of the pulley.

FIGURE 16



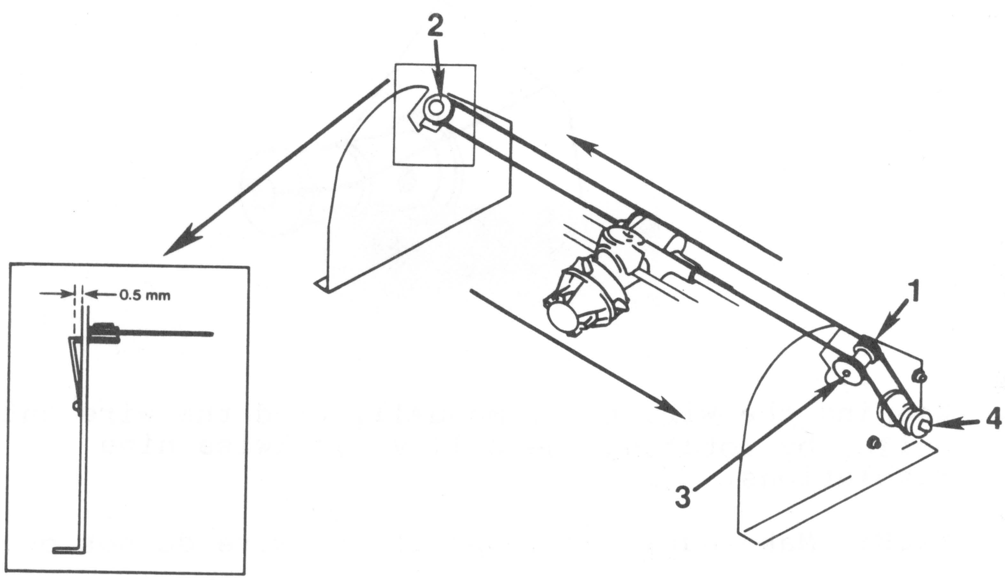
6. Keeping the wire taut, manually wind the wire onto the pulley by rotating the pulley clockwise nine revolutions.

   NOTE: Make sure the loops of the wire do not overlap.

   Once the wire is wound, hold it down with the tape.

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FIGURE 17

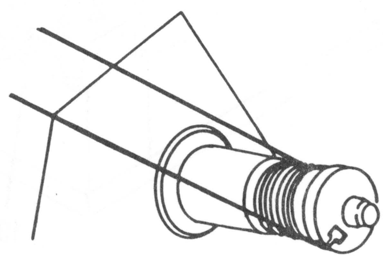


7. Thread the wire around the guide pulleys, following the arrows, in numerical order as shown in Figure 17, #1, #2, and #3.

8. Place the tape on the motor pulley so that you can access the short slot of the pulley.

9. Slip the end of the carriage wire into the short slot of the motor pulley. (See Figure 18.) This should be a tight fit. If it isn't tight, give the pulley another revolution.

FIGURE 18



(If you have trouble slipping the wire into place, remove the wire from the left guide pulley, slide the wire end into place, and then pull the wire back onto the guide pulley.)

10. Tighten the mounting screw for the left guide pulley.

11. Adjust the wire tension (see steps in the following section).

12. Remove the tape from the pulley motor.

13. Turn the motor pulley until it has an equal number of turns on either side of where the carriage wire leaves the motor pulley.

14. Slide the pen carriage to approximately the middle of the carriage/bed assembly.

15. Place the carriage wire closest to you under the retaining clamp on the pen carriage. Tighten the retaining clamp screw.

apple computer

FIGURE 19

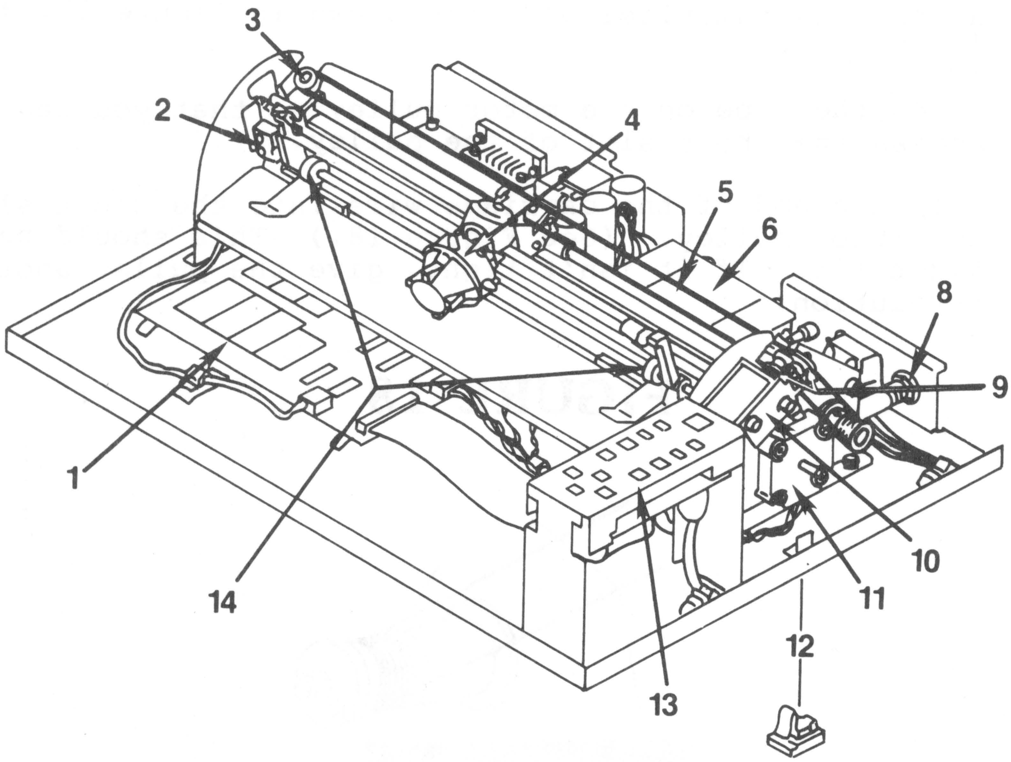
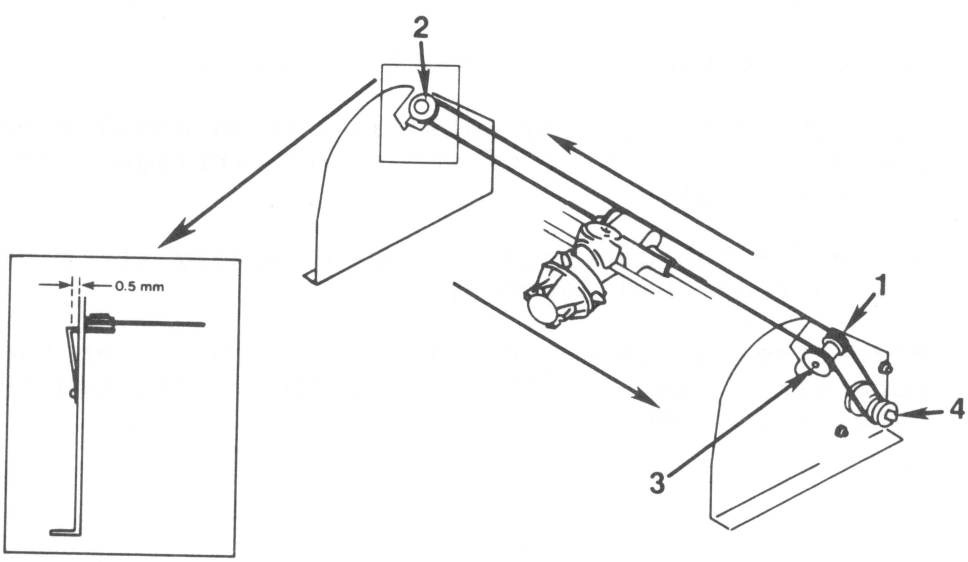


FIGURE 20



16. Slide the pen carriage back and forth to check that it can reach both ends of the carriage/bed assembly. (Note: The right feed-roller should be to the far right.)

    If the pen carriage cannot reach both ends, loosen the retaining clamp on the carriage assembly, move the pen carriage in the direction that was difficult to reach, and then tighten the retaining clamp and try it again.

Adjust Carriage Wire Tension

Read the following two paragraphs before proceeding with the numbered steps.

The carriage wire tension is adjusted by rotating the pulley motor.

The wire tension is correctly adjusted when the left pulley assembly (Figure 19, #3) is approximately 0.5 mm (1/48 inch) from the carriage/bed assembly when measured at the upper end of the left pulley assembly. (See insert, Figure 20.)

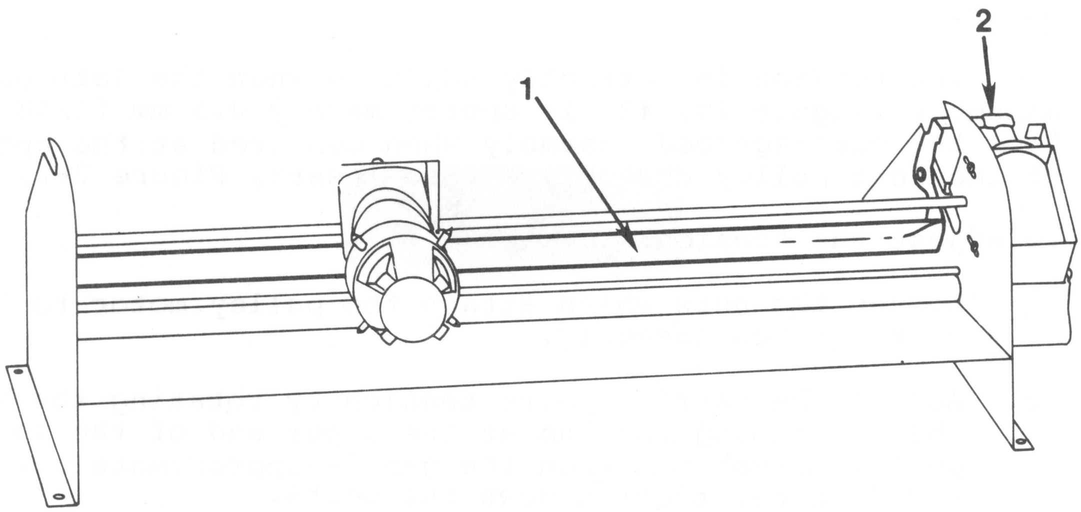
To adjust the tension:

1. Loosen the nuts which attach the pulley motor to the carriage/bed assembly.
2. Adjust the carriage wire tension by rotating the motor while watching the gap at the upper end of the left pulley assembly. When the gap is approximately .5 mm (1/48 inch), tighten down the bolts.
3. Tighten the nuts when the pulley assembly is correctly adjusted.

NOTE: If you were replacing the carriage wire, return to step 12 of the Replace Carriage Wire section above and continue from there.

NOTE: If you were replacing the pulley motor, return to step 10 of Replace Pulley Motor and continue from there.

FIGURE 21



Remove and Replace Solenoid - Figure 21, #2

The solenoid moves the pen carriage up and down.

1. To remove the solenoid, remove the two screws which attach it to the carriage/bed assembly.

2. Replace the solenoid by loosely tightening the solenoid screws, adjusting the solenoid, and then tightening down the screws.

Solenoid Adjustment

Read the following paragraphs before doing the numbered steps.

The solenoid adjustment determines the pen height. In making this adjustment you are concerned with the solenoid, bail, bail lever, and pen carriage.

Look underneath the pen carriage to see where the bail (Figure 21, #1) comes into contact with the pen carriage. Push in bail lever to depress the cylinder on top of the solenoid (Figure 21, #2). Watch the bail move.

The gap between the bail and the pen carriage should be approximately 1 mm (measured when an uncapped pen is touching the platter and the solenoid cylinder is pushed in).

To adjust:

1. Put uncapped pens in pen carriage.

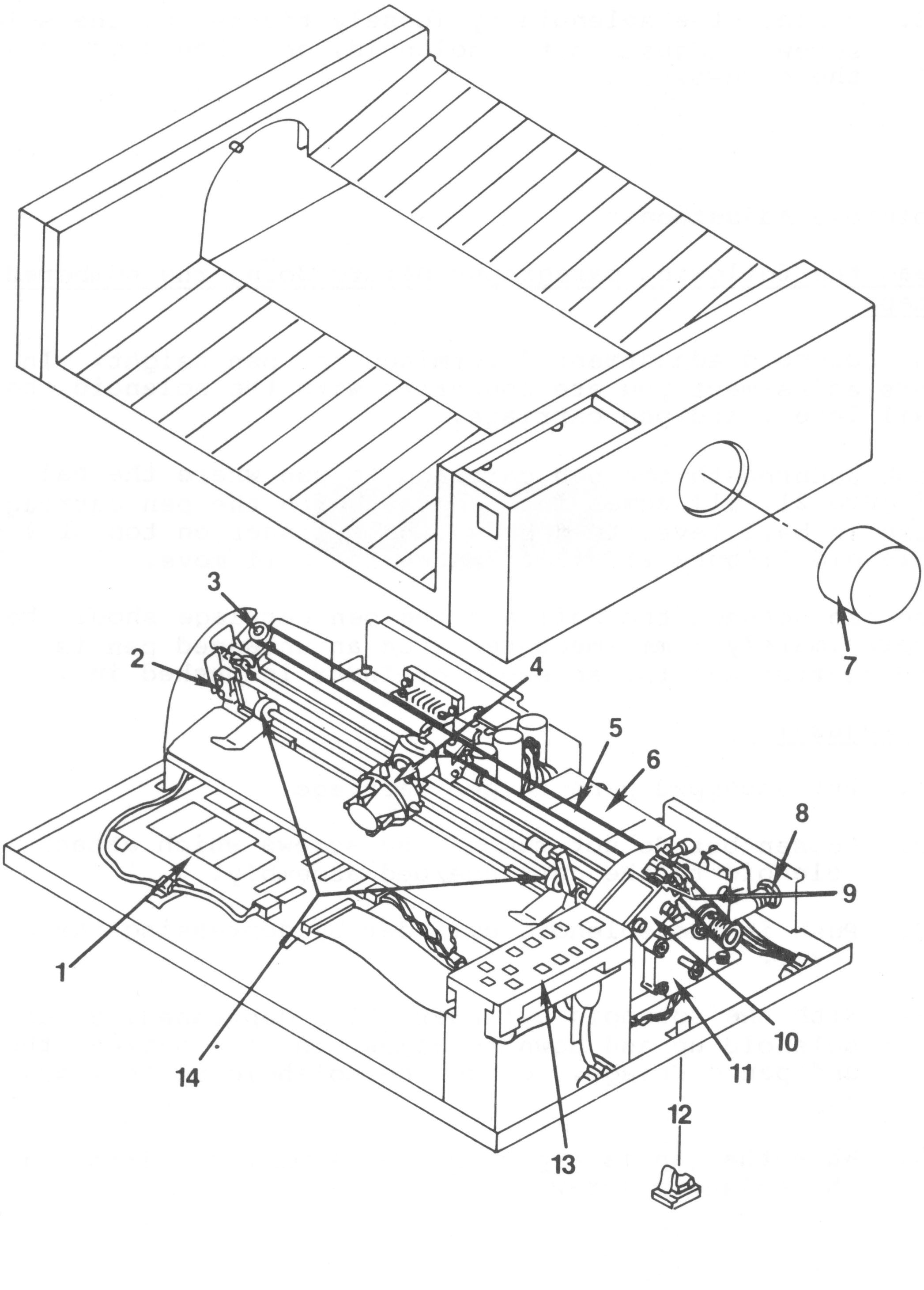
2. Loosen but do not remove the screws which attach the solenoid to the carriage/bed assembly.

3. Push in the solenoid cylinder by depressing the bail lever.

4. With the solenoid cylinder still depressed, guide the solenoid up and down to adjust the gap between the bail and pen carriage. Guide the solenoid up to lessen the gap.

5. When the gap is approximately 1 mm (1/24 inch) tighten the solenoid screws.

FIGURE 22



Remove and Replace Home Position Switch Assembly - Figure 22, #2.

1. Disconnect the home position switch connector (CN7) from the PC board.

2. Remove the screw and washer which hold the switch bracket in place.

3. Replace the home position switch assembly and its screw.

   NOTE: When installed, the switch and bracket should be parallel with the sides of the rectangular cut-out in the carriage/bed.

4. Feed wires back through circular hole in the left side of the carriage/bed assembly so that the connector comes out under the carriage/bed.

5. Connect the home position switch connector to the PC board.

Remove Pen Carriage Assembly - Figure 22, #4.

To remove the pen carriage assembly you will have to remove the two bars to which it is attached. Turn the plotter so that it is facing you.

<u>To remove the rear bar:</u>

1. Remove the pens from the carriage.

2. Put tape around the wires on the motor pulley.

3. Loosen the wire-retaining-clamp screw of the pen carriage.

4. Remove the left pulley assembly (Figure 22, #3).

5. Remove the e-clip on the far right of the bar (outside of the carriage/bed) using needlenose pliers. Slide the bar out.

FIGURE 23

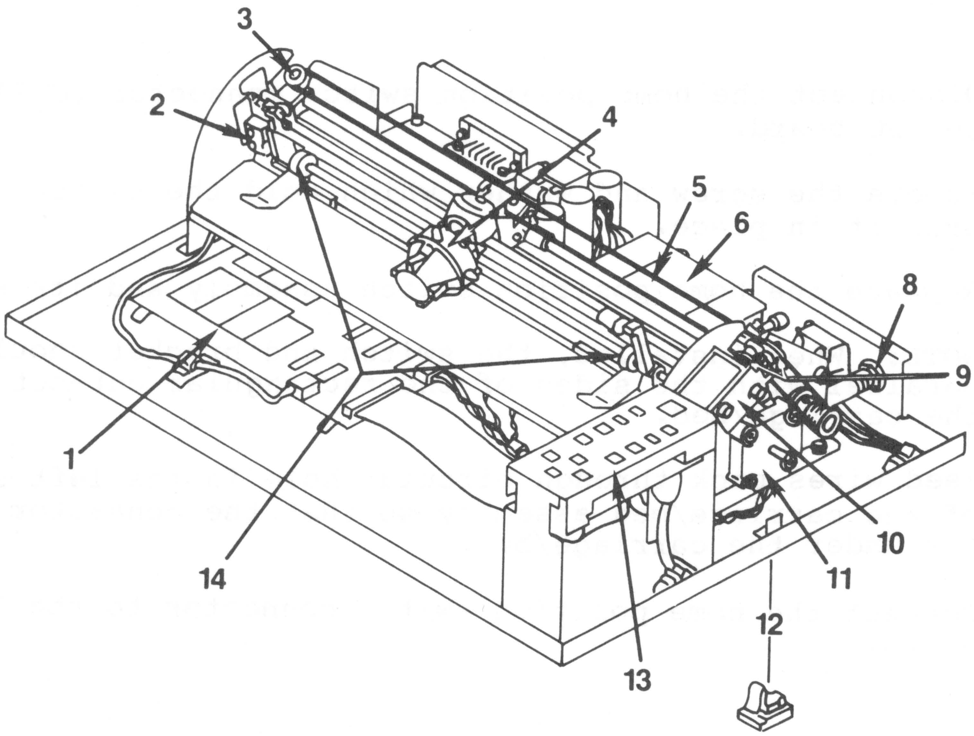
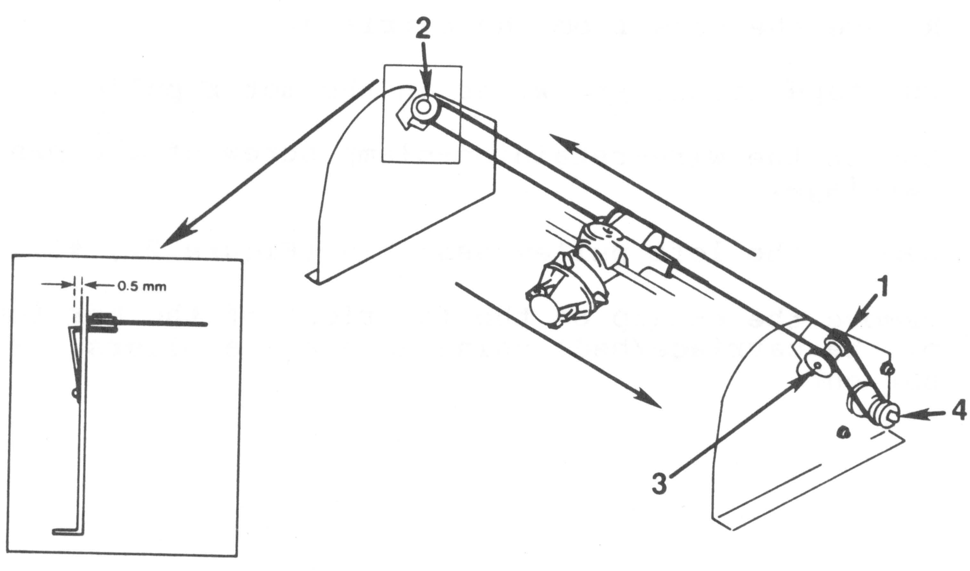


FIGURE 24



To remove the front bar:

6. Remove the screw and washer that holds in place the front bar (and the home position switch bracket [Figure 23, #2]). Pull this bar out. The pen carriage assembly is now free.

Replace Pen Carriage Assembly

1. Replace the rear bar, threading it through the pen carriage. Replace the left guide pulley. Put the e-clip in place.

2. Replace the forward bar, threading it through the pen carriage.

3. Replace the home position switch and tighten the screw.

   NOTE: When installed, the switch and bracket are parallel with the rectangular cut-out in the carriage/bed.

4. Replace the left pulley assembly.

   NOTE: When in place, the pulley should be inside the frame of the carriage assembly. (See Figure 24, insert.)

5. Put the carriage wire over the left pulley.

6. Put the carriage wire under the retaining clamp of the pen carriage and tighten the screw.

7. Check the guide pulleys (Figure 23, #3 and #9) and the motor pulley to see that the carriage wire is wound correctly.

8. Check the carriage wire tension.

Remove and Replace Fuse Figure 23, #8.

1. Use a flatblade screwdriver to turn fuse cover 1/4 turn to the left.

2. Put new fuse in cover and replace the cover.

FIGURE 25

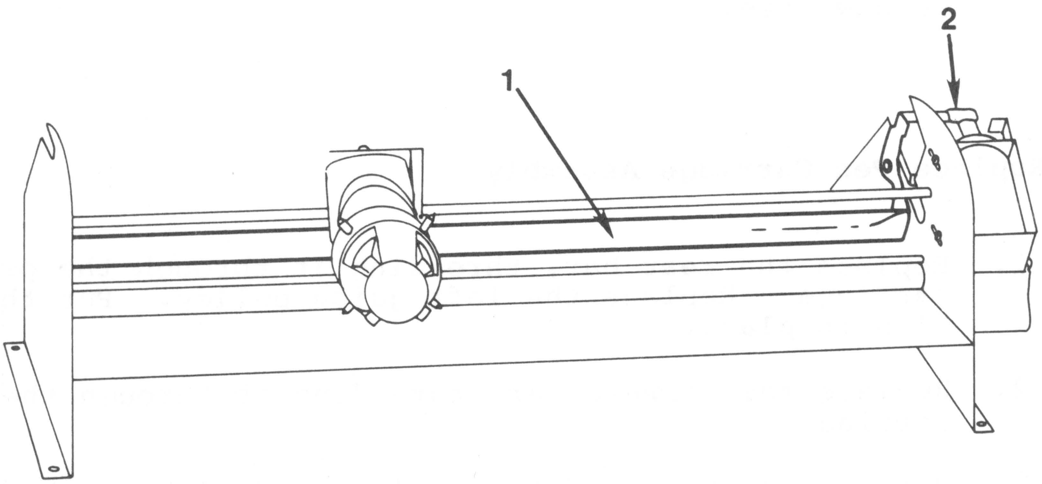
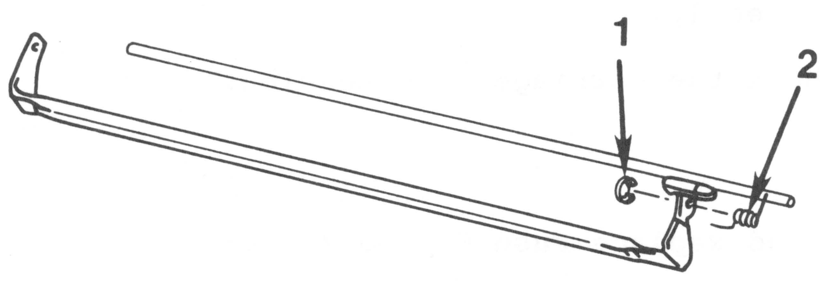


FIGURE 26



Remove Bail Spring

The bail is the rod that is moved by the solenoid (Figure 25, #1). The spring is on the far right side of the bail, inside the carriage/bed.

1. Remove the e-clip using needlenose pliers (Figure 26, #1).

2. Gently slide the bail to the left, up, and toward you so you can get at the spring.

   NOTE: Be careful. The bail is flexible and you can easily bend it out of shape.

3. Remove the spring.

Replace Bail Spring

1. Put the spring back on the assembly. The right-angle side should be to the left.

2. Replace the bail and the e-clip.

3. The straight end of the spring should lie on top of the rear bar. (See Figure 26, #2.) The right-angled side should lie on top of the bail.

Color Plotter Technical Procedures

Section 4

Illustrated Parts List

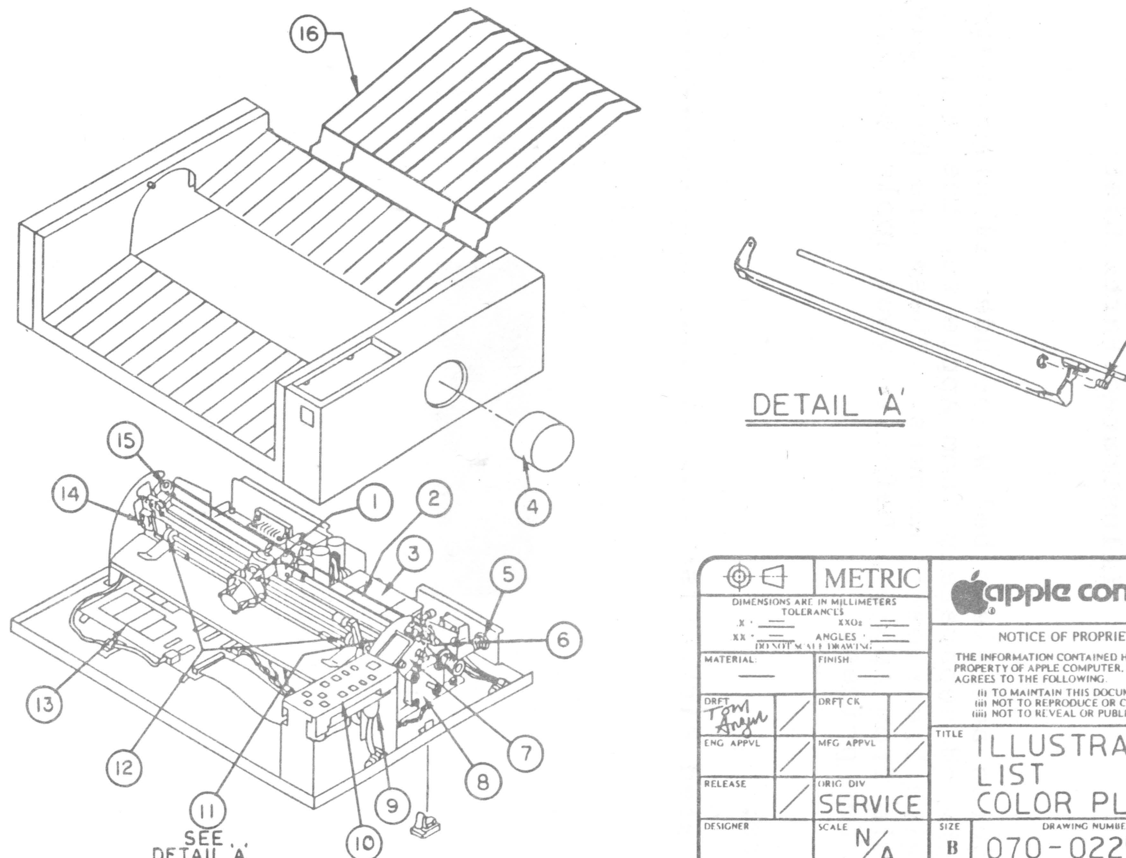
The figures and lists below include all piece parts that can be purchased separately from Apple for the Color Plotter, along with their part numbers. These are the only parts available from Apple. Refer to your Apple Service Programs manual for prices.

Contents:

apple computer

NOTE: UNLESS OTHERWISE SPECIFIED

REV	ZONE	ECO #	REVISION	APPD	DATE
A		5493	INITIAL RELEASE		



METRIC

DIMENSIONS ARE IN MILLIMETERS
TOLERANCES
.X ± —— .XXO ± ——
.XX ± —— ANGLES ± ——
DO NOT SCALE DRAWING

MATERIAL	FINISH
DRFT Tom Angus	DRFT CK
ENG APPVL	MFG APPVL
RELEASE	ORIG DIV SERVICE
DESIGNER	SCALE N/A

TITLE: ILLUSTRATED PARTS LIST
COLOR PLOTTER

SIZE	DRAWING NUMBER	SHT
B	070-0225-A	1/1

apple computer

Color Plotter

Item	Part No.	Description
1	970-0588	Pen/Carriage Assembly
2	970-0587	String Assembly
3	970-0583	Transformer
4	970-0597	Knob/Clutch Assembly
5	740-0203	Fuse
6	970-0596	Right Pulley Assembly
7	970-0589	Solenoid Assembly
8	970-0590	Motor Assembly
9	970-0586	AC Switch
10	970-0585	Keyboard Assembly
11	970-0593	Spring
12	970-0591	Feed Roller
13	661-95147	Color Plotter Main PCB
14	970-0592	Home Switch Assembly
15	970-0595	Left Pulley Assembly
16	919-0059	Back Paper Support

Parts List and Location on Figure 1

Fig. No.	Part Name	Part No.
1	Main PC board	699-0204
2	Home Position Switch Assembly	970-0592
3	Left Pulley Assembly	970-0595
4	Pen Carriage Assembly	970-0588
5	Carriage Wire	970-0587
6	Transformer	970-0583
7	Knob/clutch Assembly	970-0597
8	Fuse	740-0203
9	Spring (located rt. side of bail)	970-0593
10	Solenoid Assembly	970-0589
11	Paper Feed Motor (pulley motor same part no.)	970-0590
12	Tab	no number
13	Keyboard Assembly	970-0585
14	Feed rollers	no number
	On/off Switch (AC switch) (in keyboard assy.)	970-0586

Graphics Tablet

apple computer

GRAPHICS TABLET TECHNICAL PROCEDURES

TABLE OF CONTENTS

Graphics Tablet Technical Procedures

Section 1

Apple //e Installation

CONTENTS:

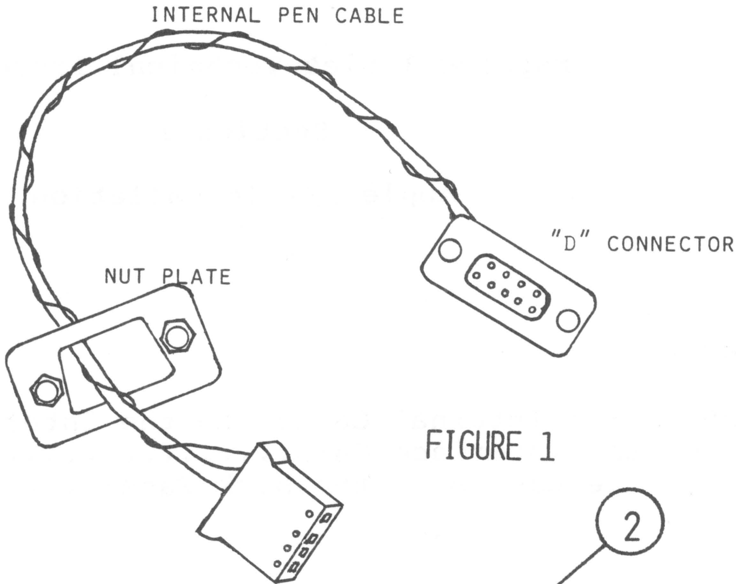


FIGURE 1

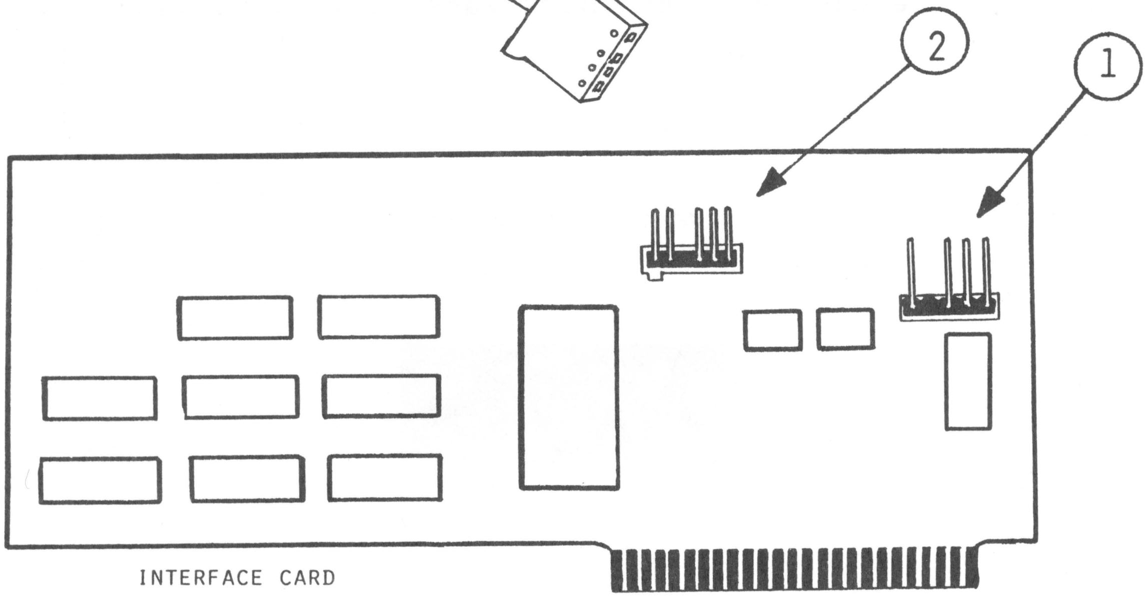


FIGURE 2

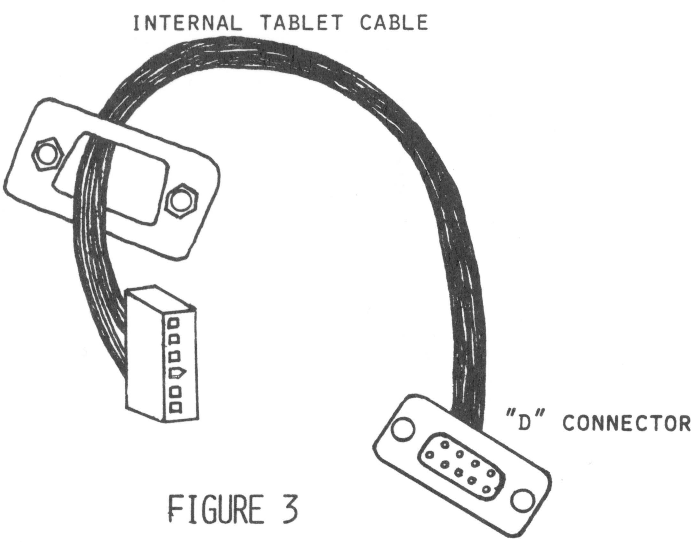


FIGURE 3

apple computer

INTRODUCTION

The new Graphics Tablet RFI is functionally identical to that of the NON-RFI Graphics Tablet, A2M0029. Minor changes have been made to meet EMI specifications required by the FCC.

EQUIPMENT REQUIRED

To install the Graphics Tablet on an Apple //e you will need:

- o Small flatblade screwdriver
- o Two nut plates
- o Four hexagonal-head screws
- o The small wrench that comes with the Graphics Tablet

NOTE: The large, gray-metal, two-piece connector clamp that comes with the interface card is not needed for Apple //e installation. It is only used with earlier models of the Apple][.

A. CONNECTING THE INTERNAL CABLES TO THE INTERFACE CARD

1. Find the internal pen cable and one of the nut plates (see Figure 1). This cable has a "D"-shaped connector at one end and a small slip-on connector at the other end with four holes in it. Put the slip-on connector through the nut plate, with the nuts facing away from the "D"-shaped connector.

2. Locate a set of four pins near the top right edge of the interface card (see Figure 2, #1) and slide the slip-on connector onto the pins.

3. Now find the internal tablet cable and put its slip-on connector through the nut plate, with the nuts facing away from the "D"-shaped connector (See Figure 3).

4. Slide this connector onto the second set of pins (see Figure 2,#2) on the interface card to the left of the first cable you connected.

apple computer

B. INSERTING THE INTERFACE CARD

1. Unplug the power cord from the back of the computer.

2. Remove the cover of the Apple computer. You will install the interface board into one of the expansion slots at the back of the main board. The slots are numbered from 1 to 7 with slot 1 nearest to the power supply case. The interface card will work properly in any slot except slot 3. Slot 5 is a good choice because it's near the location where the "D" connectors will be installed on the back of the computer.

3. Insert the interface card into slot 5.

C. ATTACHING THE CABLES TO THE BACK PANEL

1. Now turn the computer around and look at the back panel. You'll see several numbered openings with rectangular plugs in them. Openings 5 and 6 will be used for the Graphics Tablet connectors (actually, any of the openings may be used as long as they are the same size). Remove the hole plugs in openings 5 and 6 by presssing down and out on the plastic tab on the back of each plug.

2. Slide the nut plate up the tablet internal cable until it's right up against the "D"-shaped connector. The tablet internal cable is the one connected closest to the middle of the interface card.

3. Next put the connector and nut plate up against the bottom opening in the back panel (opening 6). The connector should be in direct contact with the back panel, the nut plate should be directly behind the connector, and the part of the connector with the nine holes in it should be protruding through the opening.

4. Now insert the hexagonal-head screws from outside the computer through the notches above and below the opening in the back panel, then through the holes in the connector, and finally through the holes in the nut plate. Tighten the screws with the wrench that came in the Graphics Tablet package.

5. Plug the cable from the Graphics Tablet into the internal cable connector. Finish the connection by tightening the two screws.

6. Now attach the internal pen cable to opening 5 on the back panel.

7. Next plug the external pen cable into the internal pen connector. Tighten the two screws.

8. Double-check all of the connections you've made, using this list:

   - the internal tablet cable is attached to the external tablet cable
   - the internal pen cable is attached to the external pen cable
   - the interface card is firmly seated
   - the "D"-shaped connectors are firmly plugged in and the screws are tightened down

9. Put the cover back on the computer.

apple computer

Graphics Tablet Technical Procedures

Section 2

Apple][or Apple //-Plus Installation

CONTENTS:

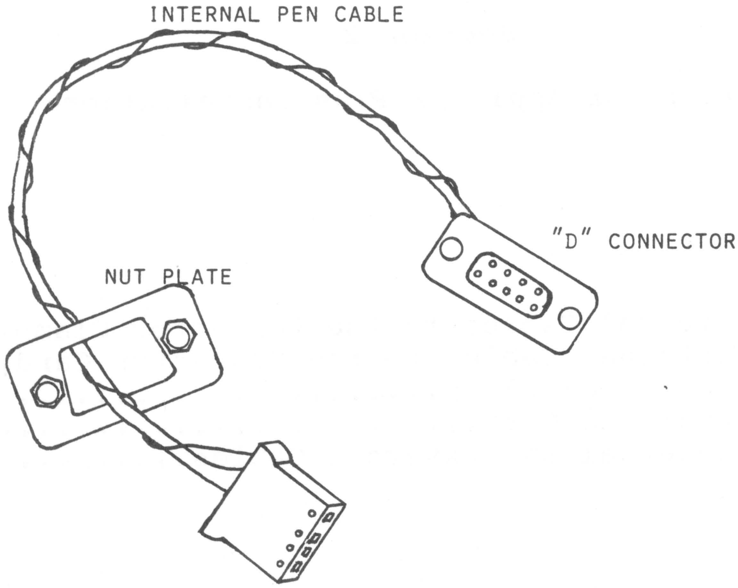


FIGURE 1

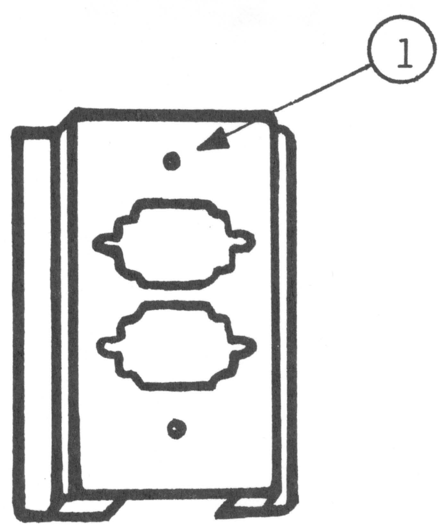


FIGURE 2

apple computer

INTRODUCTION

The new Graphics Tablet is functionally identical to the non-RFI Graphics Tablet, A2M0029. Minor changes have been made to meet the EMI specifications required by the FCC.

EQUIPMENT REQUIRED

To install the Graphics Tablet on an Apple][or // Plus you'll need these items:

- The large, gray-metal, two-piece clamp that comes with the Graphics Tablet
- Two nut plates
- Two Phillips-head screws
- Four hexagonal-head screws
- The small wrench that comes with the Graphics Tablet
- Small Phillips screwdriver
- Small flat blade screwdriver

A. ATTACHING THE INTERNAL CABLES TO THE CONNECTOR CLAMP

1. Find the internal pen cable and one of the nut plates (See Figure 1). This cable has a "D"-shaped connector at one end and a small slip-on connector at the other end with four holes in it. Put the slip-on connector through the nut plate, with the nuts facing away from the "D"-shaped connector.

2. Find the front piece of the two-piece connector clamp (See Figure 2). The top is the end where the screw hole is nearer the edge (see Figure 2,#1). Put the "D"-shaped connector and nut plate right up against the top opening. The connector should be in direct contact with the clamp, the nut plate should be directly behind the connector, and the part of the connector with the nine small holes in it should be protruding through the opening in the clamp.

3. Attach the connector and the nut plate to the clamp by putting the hexagonal-head screws through the front of the clamp, then through the holes in the "D"-shaped connector, and finally through the nut plate. Tighten down the screws with the small wrench that came with the Graphics Tablet.

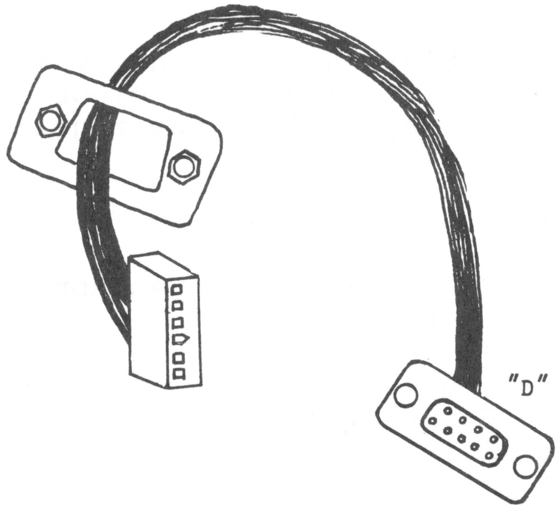


FIGURE 3

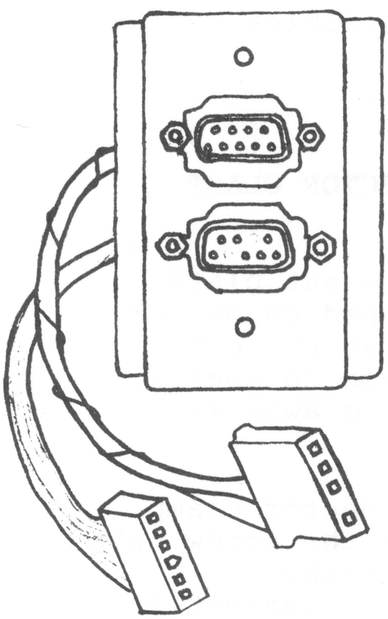


FIGURE 4

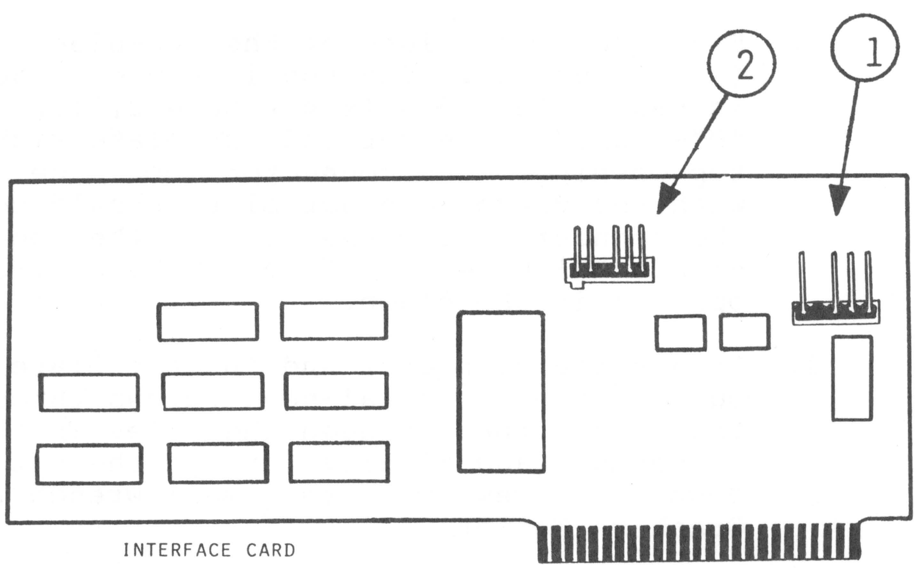


FIGURE 5

4. Now find the internal tablet cable (see Figure 3). It has a slip-on connector with six small holes on one end. Slide the slip-on connector through the other nut plate, making sure that that the nuts are facing away from the "D"-shaped connector.

5. Attach the connector and nut plate, as you did in steps 2 and 3, to the bottom opening of the connector clamp. The assembled connectors are shown in Figure 4.

6. Now that the connectors are attached to the front of the clamp, fit the two clamp pieces together to form a "box" and put the two internal cables through the side opening on the back of the clamp. Make sure the screw holes line up. Attach the two clamp pieces with two Phillips head screws. Don't tighten the screws completely yet.

B. CONNECTING THE INTERNAL CABLES TO THE INTERFACE CARD

1. The internal pen cable should now be attached to the top cutout in the connector clamp. Check to see that the small slip-on connector at the end has four holes.

2. Locate a set of four pins near the top right edge of the interface card (see Figure 5, #1) and gently slide the slip-on connector onto the pins.

3. Now find the Graphics Tablet internal cable. It should be attached to the bottom cutout on the front of the connector clamp.

4. Slide the end with the slip-on connector onto the second set of pins (see Figure 5,#2) on the interface card to the left of the first cable you connected.

C. INSTALLING THE CONNECTOR CLAMP

1. Unplug the power cord from the back of the computer and remove the cover.

2. Look at the back panel of the computer. The connector clamp will be installed into one of the three deep vertical notches. Take the connector clamp and slide it down as far as it will go into one of the notches. If you have trouble sliding the connector down into the notch, loosen the two Phillips head screws and then push it down into the slot. Now tighten the screws that hold the clamp assembly together until the clamp can no longer be moved in the opening.

D. INSERTING THE INTERFACE CARD

1. You will install the interface card in one of the expansion slots. The slots are numbered from 0 to 7 with slot 0 nearest to the power supply. The interface card will work properly in any slot except slot 0. Insert the interface card into a slot near the connector clamp.

E. CONNECTING THE INTERNAL AND EXTERNAL CABLES

1. Now find the cable attached to the Graphics Tablet pen and plug it into the top connector. Complete the connection by tightening the screws on the external pen connector.

2. Plug the connector on the cable attached to the Graphics Tablet into the bottom connector. Complete the connection by tightening the screws on the external tablet connector.

3. Double-check all of the connections you've made, using this list:

   - the internal tablet cable is attached to the external tablet cable
   - the internal pen cable is attached to the external pen cable
   - the interface card is firmly seated
   - the "D"-shaped connectors are firmly plugged in and the screws are tightened down

4. Put the cover back on the computer.

apple computer

Graphics Tablet Technical Procedures

Section 3

Troubleshooting

Contents:

SYMPTOM TABLE

CAUTION: Diskettes and video tapes can be erased by the magnetism of the Graphics Tablet or biasing magnet. Do not store diskettes or video cassettes on or near the Graphics Tablet or biasing magnet.

SYMPTOM	CORRECTIVE ACTION
MONITOR DISPLAYS: "NOT DETECTING INTERFACE CARD"	1. Check interface card firmly seated 2. Clean card contacts ("fingers"). 3. Replace interface card.
UNABLE TO DRAW OR SELECT MENU COMMANDS WITH THE PEN	1. Swap the following components in this order: o Interface card o Pen o Internal pen cable o Internal tablet cable o Graphics tablet
APPLE //e "BEEPS" WHEN TYPING GRAPHICS TABLET COMMANDS	1. Press the "CAPS LOCK" key and retype the command. Apple //e will not accept lower case commands with the graphics tablet software.
ERRATIC DRAWING: EXTRA OR MISSING DOTS	1. Wipe the tablet surface and the menu with the anti-static cloth

CAUTION: When using the biasing magnet, keep the magnet away from diskettes and video tapes. A magnetic field can erase information.

2. With power off, draw the biasing magnet across the surface using a slow continuous motion in a single direction. Do this for each direction; left to right, top to bottom, and diagonally.

3. Boot the Graphics Tablet Software diskette.

4. Select MENU ALIGNMENT and follow the instructions on the monitor.

NOTE: If the tablet does not pass the MENU ALIGNMENT procedure, perform the following procedure, PEN ALIGNMENT.

PEN ALIGNMENT

To perform this procedure, you will need the following:

- o Apple II Product Diagnostic Diskette (P/N 077-0100)
- o Pen alignment block
- o Nylon coil adjustment tool
- o Sheet of 1/8" plexiglass
- o Anti-static cloth

1. Boot the Apple II Product Diagnostic diskette.

2. Select CARD TESTS and after that GRAPHICS TABLET TEST.

   NOTE: To avoid confusion follow the instructions given here rather than the instructions displayed on the screen, as they sometimes refer to things you should do after you have pressed ESC to proceed to the next screen.

3. Press ESC and wait for the ROM test. If the ROM test fails, replace the interface card.

4. Press ESC.

5. Place the pen in the wooden alignment block.

6. Place the alignment block so that the pen is between the eighth and ninth lines (counting the top border of the graph as line 1) in the column called "dots".

7. Press ESC twice.

8. Insert the nylon coil adjustment tool into the top of L2 (upper left corner of the interface card), and turn the slug counterclockwise until it is even with the top of the sleeve; then turn it clockwise until the crosshairs stabilize in the middle box. Continue to turn until they disappear again.

9. Now turn it counterclockwise again until the crosshairs first stabilize within the middle box.

10. Look straight down on the top of the tool and notice what direction the blade is pointing in.

11. Now continue to turn the tool counterclockwise.

12. When the crosshairs lose stability and jump out of the box, restabilize them; then look at the top of the tool and note which direction the blade points.

13. The correct setting is halfway between the two points at which the crosshairs stabilize.

CHECKING THE TABLET

With the surface biased, the menu aligned, and the pen aligned, you must check the tablet to see if there are any troubles that have not been corrected.

1. Press ESC three times.
2. Wipe both sides of the sheet of 1/8" plexiglass with the anti-static cloth.
3. Place the plexiglass over the menu and with a straight edge (don't use metal), draw lines around the edges, through the middle, and diagonally. There should be no gaps, double lines, "glitches", or extraneous dots. If there are, repeat the biasing procedures, and wipe the surfaces with the anti-static cloth.
4. If there are still missing or extra dots,the unit should be sent to Level II Service Center.

Graphics Tablet Technical Procedures

Section 4

RFI Upgrade Procedures

Contents:

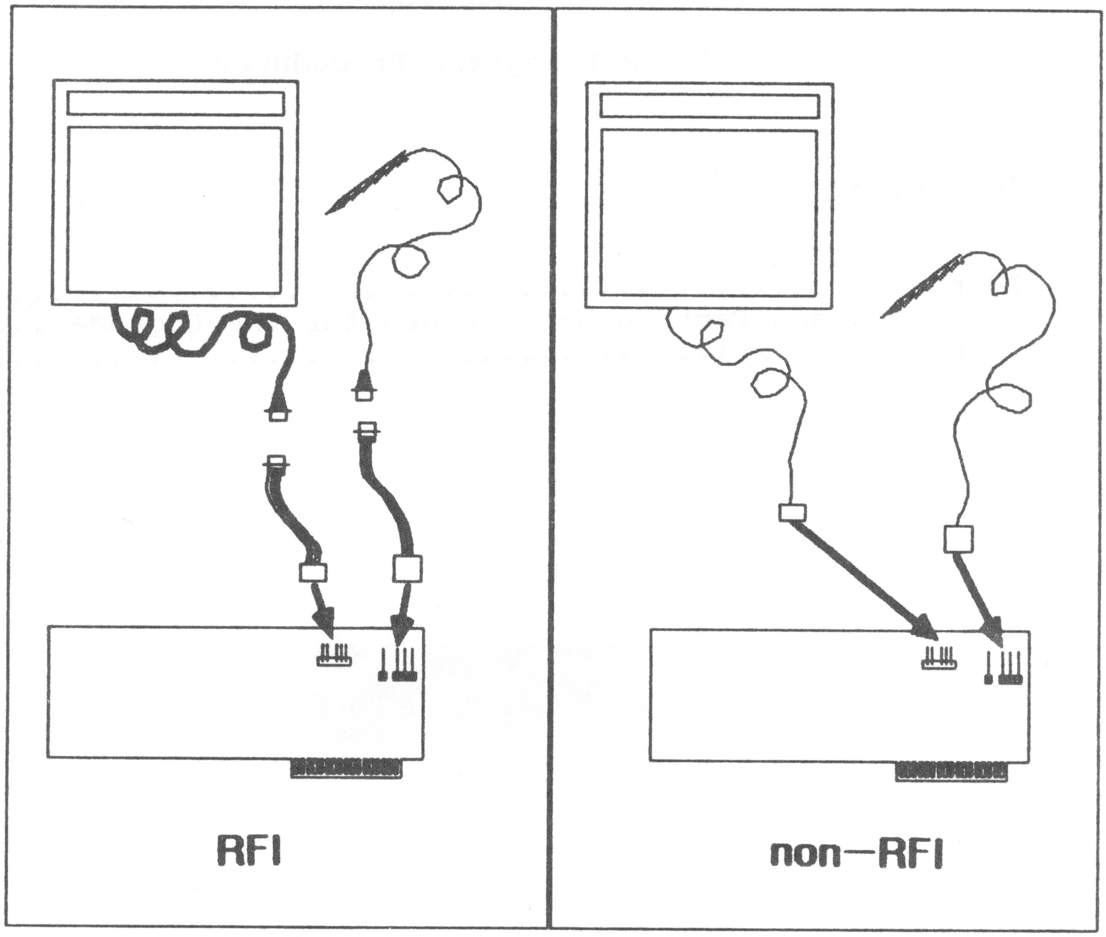


Figure 1

apple computer

INTRODUCTION

When a non-RFI Graphics Tablet is brought in for repair, you can either service it using the non-RFI parts that you have in stock or replace non-RFI modules/parts with their RFI counterparts. This section tells you what parts you will need and what to do to upgrade from a non-RFI Graphics Tablet to an RFI version.

RFI PARTS AND PART NUMBERS NEEDED FOR THE UPGRADE

You will need the following RFI parts to do the upgrade:

661-91140	Graphics Tablet Assy-RFI
661-91141	Graphics Tablet Interface Card-RFI
661-91142	Graphics Tablet Stylus RFI
590-0085	Cable Assy Tablet, Internal
590-0102	Cable Assy Stylus, Internal
600-8010	Assy, Installation Hardware (A //e)
805-0085	Clamp, Rear Peripheral Int. Conn. (A II/II+)
805-0105	Clamp, Front (A II/II+)

UPGRADING TO RFI

Refer to Figure 1, which shows the configuration for the RFI and non-RFI versions of the Graphics Tablet. Notice that the only difference for the RFI configuration is that the tablet and the pen do not connect directly to the Interface Card. Instead, they connect to a short cable, and the cable connects to the Interface Card.

NOTE: Graphics Tablet installation procedures for the Apple //e are given in Section 1 of the Graphics Tablet Technical Procedures. Section 2 gives the installation procedures for the Apple II and II Plus.

apple computer

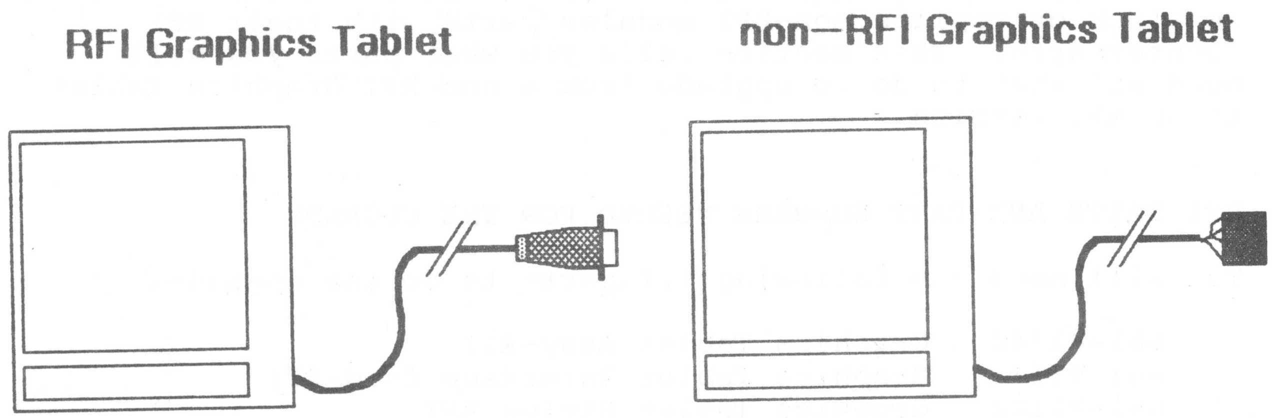


Figure 2

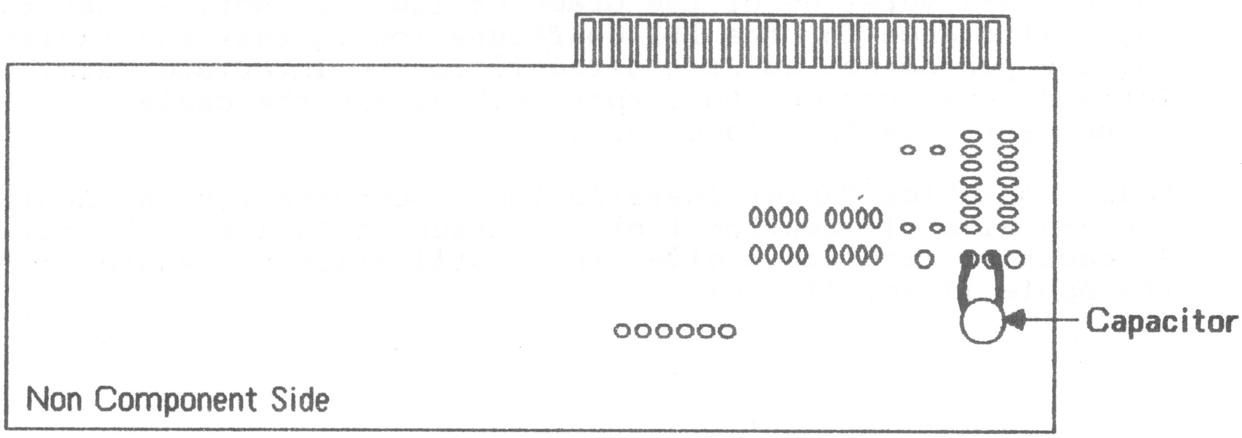


Figure 3

To upgrade to RFI, follow these steps:

1. Connect the RFI Graphics Tablet (see Figure 2) to the short cable with the colored plastic connector. Connect the other end of the short cable to the five-pronged connector on the RFI Interface Card. (See Figure 1.)

   NOTE: The RFI Interface Card has a different Rl resistor value than the non-RFI version.

   RFI   Rl = 75 Ohm-5% (purple-green-black-gold)

   Non-RFI   Rl = 470 Ohm-5% (Yellow-purple-brown-gold)

   The RFI version also has a capacitor on the noncomponent side of the card. (See Figure 3.)

2. Connect the RFI Pen (see Figure 4) to the short cable with the white plastic connector. Connect the other end of the short cable to the four-pronged connector on the RFI Interface Card. (See Figure 1.)

3. If there is a non-RFI Interface Card in the computer, remove it and then insert the RFI Interface Card into slot 4 of the computer.

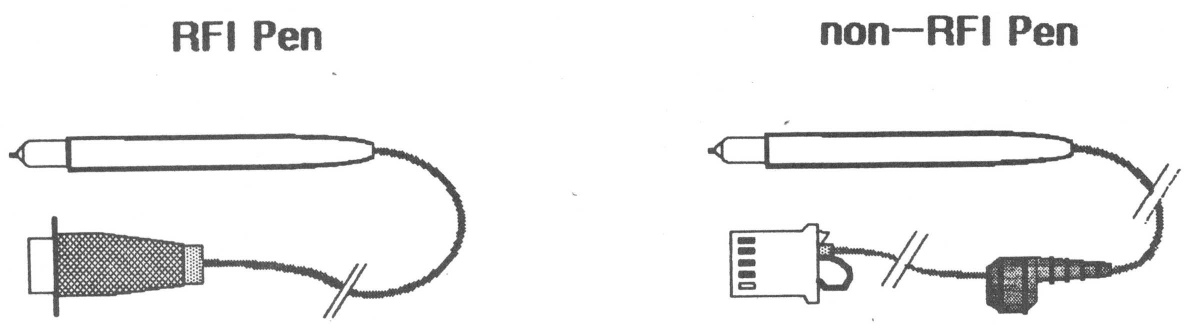


Figure 4

Graphics Tablet Non RFI-RFI Technical Procedures

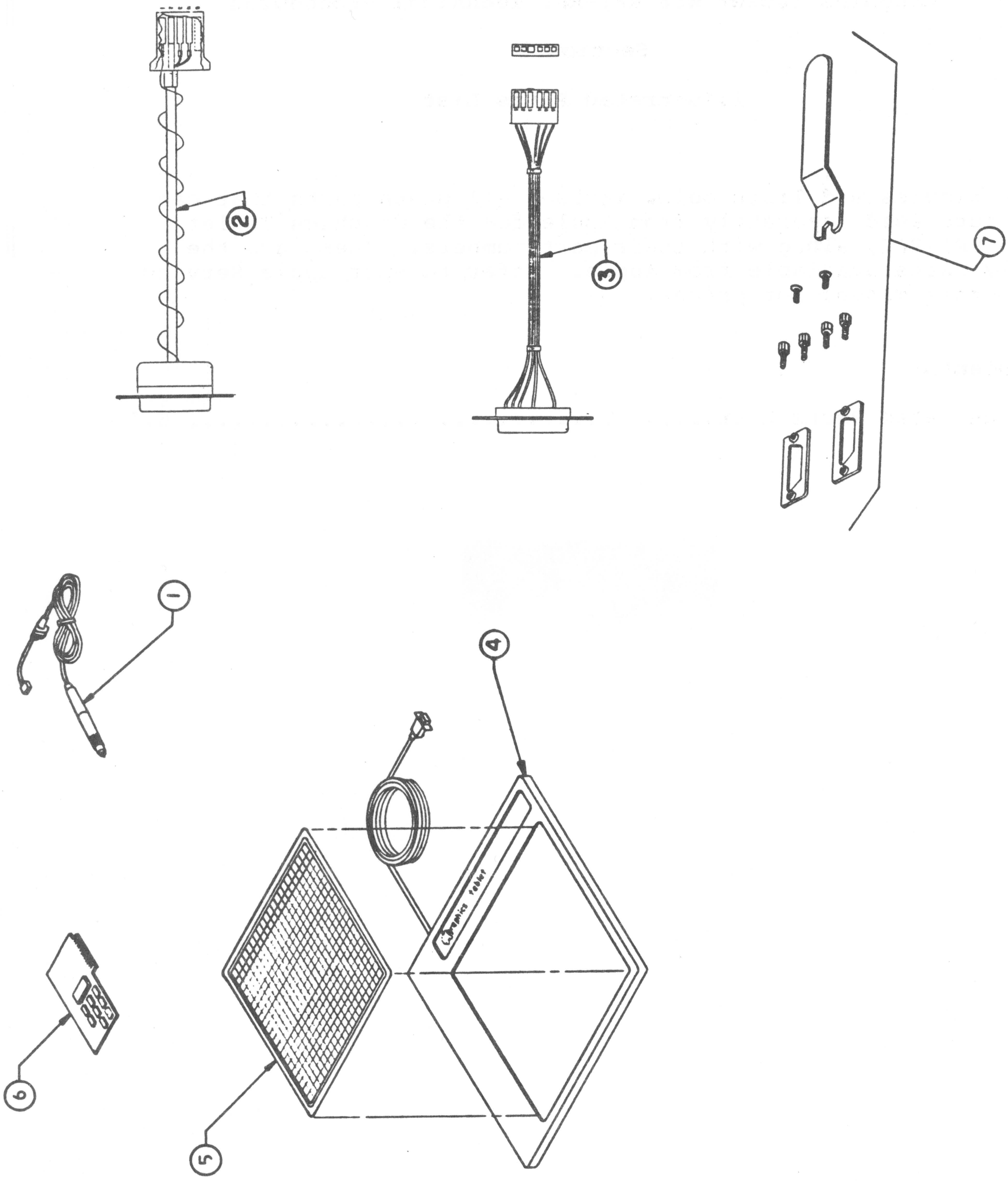
Section 5

Illustrated Parts List

The figures and lists below include all piece parts that can be purchased separately from Apple for the Graphics Tablet Non RFI-RFI, along with their part numbers. These are the only parts available from Apple. Refer to your Apple Service Programs manual for prices.

Contents:

apple computer



apple computer

GRAPHICS TABLET NON RFI-RFI

Item	Part No.	Description
1	661-91142	Graphics Tablet Stylus RFI
2	590-0102	Cable Assy Stylus, Internal
3	590-0085	Cable Assy Tablet, Internal
4	661-91140	Graphics Tablet Assy-RFI
5	825-0039	Overlay Apple Graphics Tablet
6	661-91141	Graphics Tablet Interface Card-RFI
7	600-8010	Assy, Installation Hardware (A //e)

GRAPHICS TABLET ILLUSTRATED PARTS LIST

The figure and list below includes all piece parts that can be purchased separately from Apple for the Graphics Tablet along with their part numbers. Refer to your Apple Service Programs binder for prices.

Graphics Tablet (Figure 1)

Item	P/N	Description
1	661-91142	Graphics Tablet Stylus RFI
2	590-0102	Cable Assy Stylus, Internal
3	590-0085	Cable Assy Tablet, Internal
4	661-91140	Graphics Tablet Assy-RFI
5	825-0039	Overlay Apple Graphics Tablet
6	661-91141	Graphics Tablet Interface Card-RFI
7	600-8010	Assy, Installation Hardware (A //e)
8	805-0085	Clamp, Rear Peripheral Int. Conn. (AII, AII+)
9	805-0105	Clamp, Front (AII, AII+)

Numeric Keypad

NUMERIC KEYPAD TECHNICAL PROCEDURES

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Section 1.

Section 2.

Appendix A.

Numeric Keypad Technical Procedures

Section 1

Troubleshooting
Assembly/Disassembly

Contents:

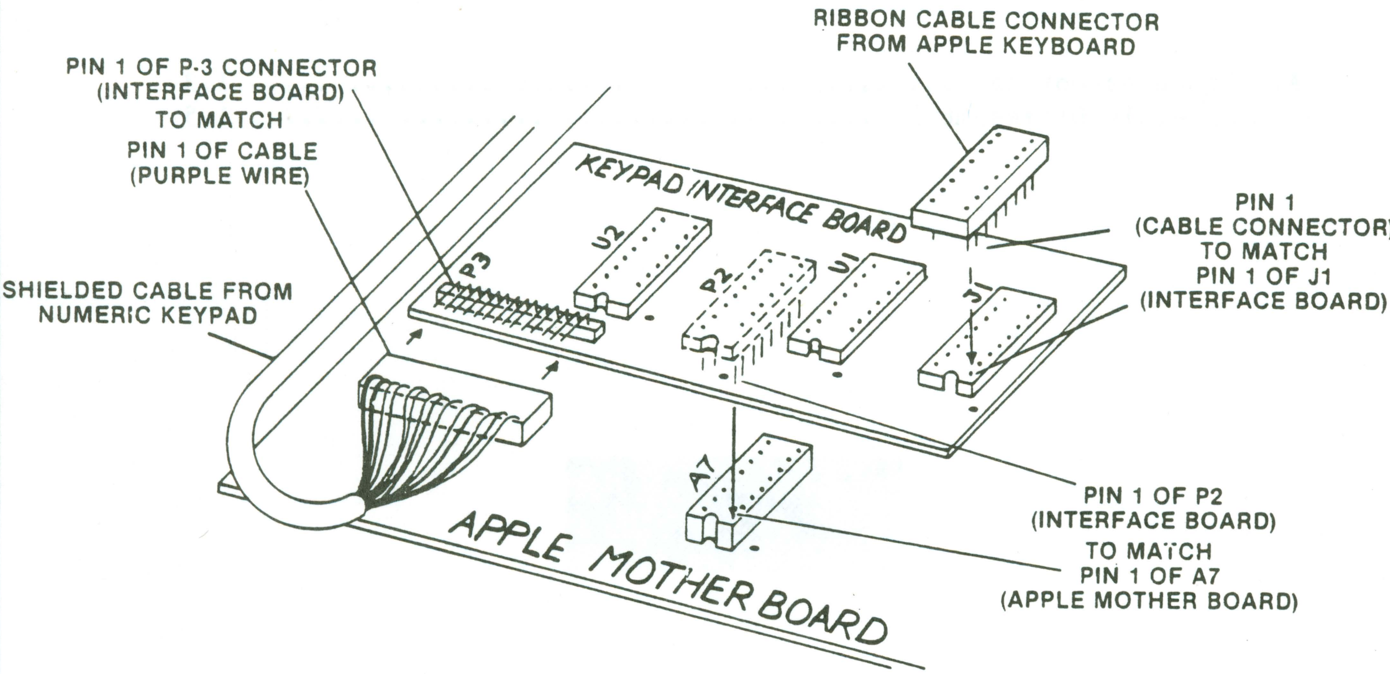

RIBBON CABLE CONNECTOR
FROM APPLE KEYBOARD
PIN 1 OF P-3 CONNECTOR
(INTERFACE BOARD)
TO MATCH
PIN 1 OF CABLE
(PURPLE WIRE)
KEYPAD INTERFACE BOARD
PIN 1
(CABLE CONNECTOR)
TO MATCH
PIN 1 OF J1
(INTERFACE BOARD)
SHIELDED CABLE FROM
NUMERIC KEYPAD
P3
U2
P2
U1
J1
A7
PIN 1 OF P2
(INTERFACE BOARD)
TO MATCH
PIN 1 OF A7
(APPLE MOTHER BOARD)
APPLE MOTHER BOARD

FIGURE A

apple computer

A. TROUBLESHOOTING GUIDE FOR THE NUMERIC KEYPAD

NOTE: The special function keys (arrows, return, etc.) on the Numeric Keypad do not work properly when used with an Apple //e containing a "revision C" character generator ROM. The Revision C ROM (part number 342-0132-C) was first shipped in the Apple //e after 8/25/84. If you encounter difficulties with the function keys on the Keypad, check to see if the Apple //e logic board contains the "revision C" ROM at location E-12. If it does **REPLACE THE CHARACTER GENERATOR ROM** with any other version from service stock (for example; part numbers 342-0132-A or 342-0132-B). **DO NOT REPLACE THE ENTIRE APPLE //e LOGIC BOARD.**

1. Confirm that the keypad is malfunctioning by running the keyboard test on the Dealer Diagnostic diskette.

When you have isolated the malfunction to the numeric keypad, determine the failed component by performing the following steps:

2. Complete steps 1a. through 1i. of ASSEMBLY/DISASSEMBLY INSTRUCTIONS (on following pages) to gain access to and remove the keypad interface board.

3. Swap the interface board with a known good unit (from spares kit), reconnecting pins and cables as shown in Figure A.

4. Test the keypad using the Dealer Diagnostic diskette keyboard test. If the pad now works, reassemble the Apple II. If the pad doesn't work, put the old interface board back in and go to the next step.

5. Swap the cable, following steps 1j and 2 to 12 of the Assembly/Disassembly instructions. (see reminder below)

6. Test the keypad using the Dealer Diagnostic diskette keyboard test. If the pad now works, reassemble the Apple II. If the pad doesn't work, remove the new cable and use the old cable in the next step.

7. Swap the keypad assembly following steps 7 to 12 of the Assembly/Disassembly instructions. (see reminder below)

8. Test the keypad using the Dealer Diagnostic diskette keyboard test. If the pad now works, reassemble it and the Apple II (steps 13 to 15 of the Assembly/Disassembly intructions). The pad SHOULD work. If it doesn't, you have defective exchange modules. Find new exchange modules and start from step 3 above.

REMINDER: Before swapping ANY unit on the numeric keypad, POWER DOWN THE SYSTEM AND REMOVE THE POWER CORD FROM THE APPLE.

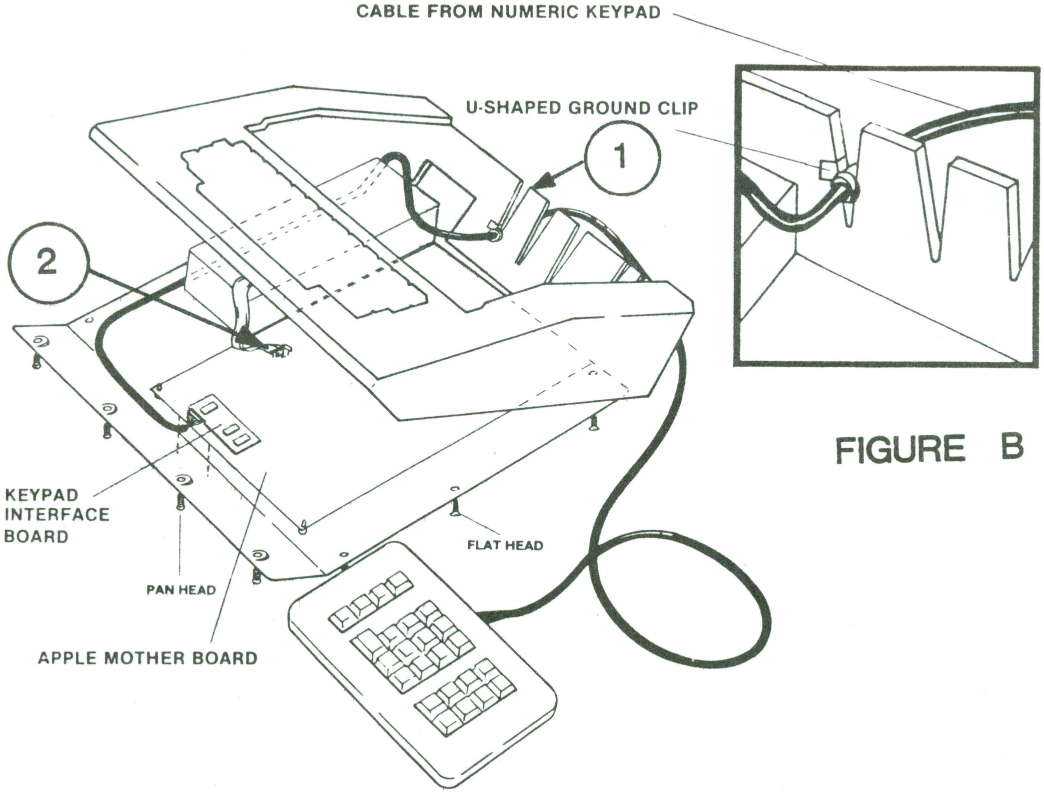
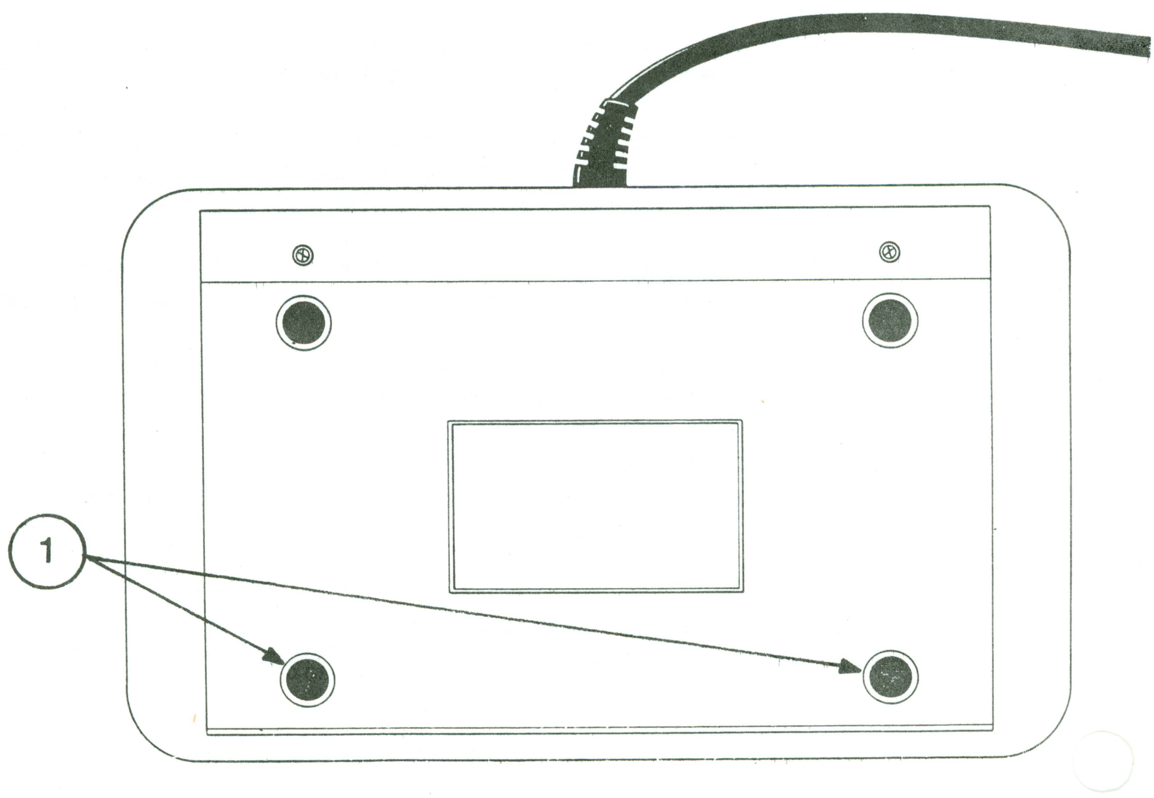


FIGURE B

FIGURE C



B. ASSEMBLY/DISASSEMBLY INSTRUCTIONS FOR THE NUMERIC KEYPAD

Items needed:

Dealer Diagnostic diskette
Medium Phillips screwdriver
Soldering iron, solder, solder wick
Replacement modules (interface card, cable, keypad assembly)
Foam pad

DISCONNECTING KEYPAD FROM APPLE

1. Complete these steps to disconnect the numeric keypad from the Apple.

   a. Power off the system and remove power cord -- first from the wall source and then from the rear of the Apple Housing.
   b. Remove Apple lid. Except for keypad cable, disconnect all other external cables connected to the Apple.
   c. Turn Apple upside down so keyboard rests on protective foam pad.
   d. Remove six flat-head screws from three outside edges of flat portion of Apple base.
   e. Remove four pan-head screws and lock washers from front of base.
   f. Holding both base and housing, turn Apple right side up. (On newer Apple II's, it may be necessary to additionally remove four round head-screws and lock washers along the rear of the Apple that fasten the mother board to the base.)
   g. Gently lift the front of the housing slightly off the base and unplug keyboard connector (see Figure B, #2) from keypad interface board.
   h. Grasp keypad interface board firmly and gently lift from motherboard.
   i. Lift housing off base and set aside (careful - keypad cable still attached)

   Do NOT proceed to next step unless you are swapping the cable or keypad assembly. Return to #3 of Troubleshooting Guide.

   j. Unthread cable through notch in rear of Apple. (see Figure B, #1)

SWAPPING THE CABLE & KEYPAD ASSEMBLY

2. Remove the 2 exposed Phillips screws on bottom of keypad case.

3. Remove the 2 LOWER rubber feet. They just pry off. (See Figure C, #1)

Continue on page following illustrations.

apple computer

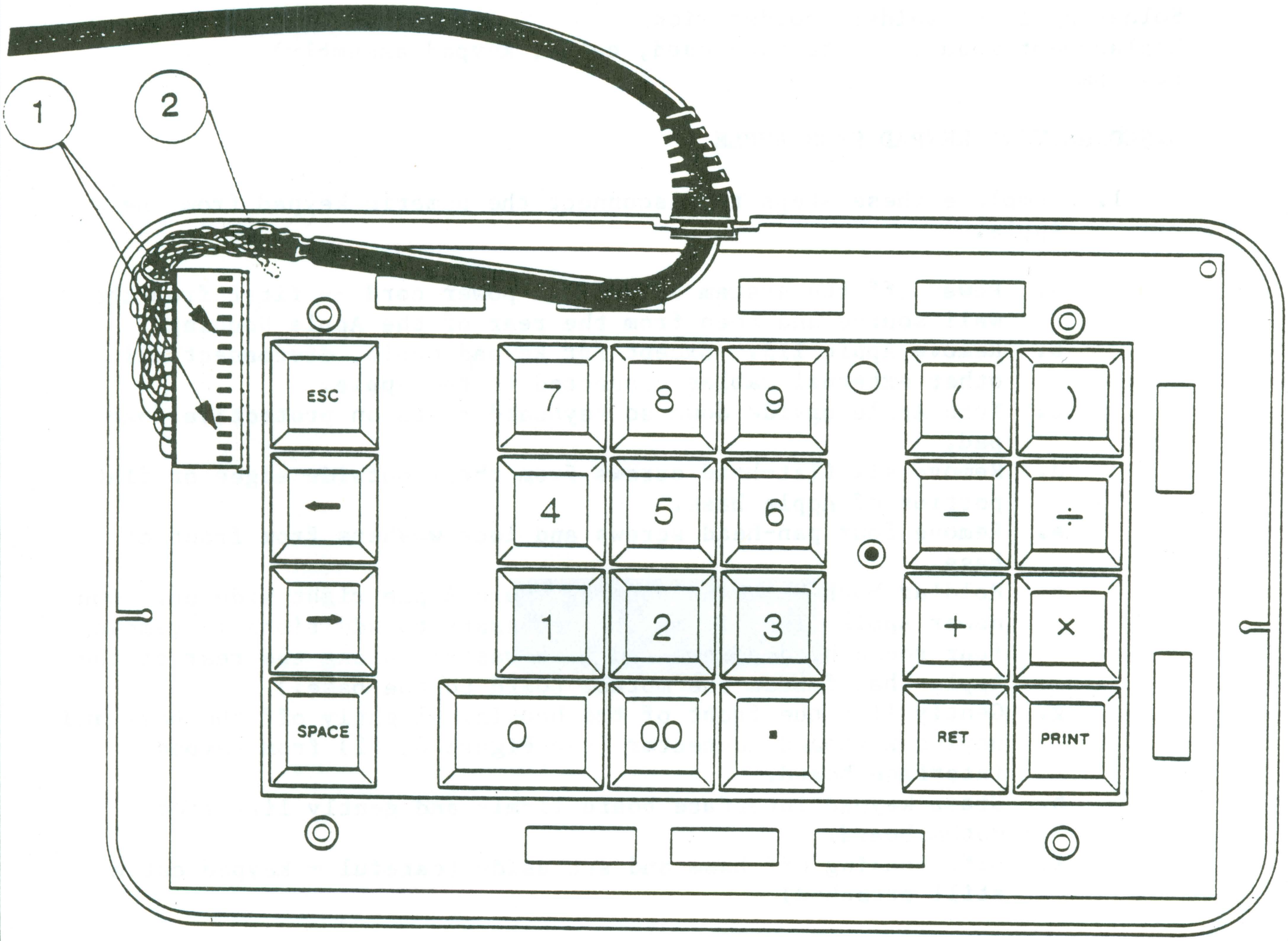


FIGURE D

4. Remove the 2 screws that are under the rubber feet you just removed.

5. Holding the case top to the bottom, turn the pad back over.

6. Remove case top by lifting off.

7. If you are replacing the CABLE ONLY, skip this step. Get the exchange keypad assembly from spares kit and set it next to the customer's keypad assembly. Pry off the key caps ONE AT A TIME, placing the cap from the customer's pad on to the new pad at the same location.

8. Note how the cable is laid and how it exits the case as shown in Figure D. Lift out customer's pad and place on normal soldering surface. (This step might not be applicable in swapping the keypad assembly.)

9. Carefully unplug the cable connector noting that the grooves of the cable connector are face up (see Figure D, #1).

10. Use a soldering iron to unsolder the grounding wire that is attached to the upper left side of the pad (see Figure D, #2)..

11. Get the appropriate cable (new one if you are replacing the cable, old one if this is a keypad swap) and plug it into the appropriate keypad assembly (old pad if this is a "cable only" swap, new pad if you are replacing the customer's pad). Note that the grooves of the cable connector are face up (see Figure D, #1).

12. Solder the ground wire to the designated area at the upper left side of the pad (see Figure D, #2).

STOP HERE! If you are CABLE SWAPPING, return to step 6 of the Troubleshooting Guide. If you are SWAPPING THE KEYPAD ASSEMBLY, return to step 8 of the Troubleshooting Guide. Do NOT reassemble keypad at this point.

13. When reassembling keypad, be sure the cable is laid correctly in the case bottom and that it points down as it exits the case as shown in Figure D. Be careful that all wires are set INSIDE the bottom of the case so none get pinched when the top is secured in place.

14. Replace case top. Turn pad over and replace 4 screws and LOWER rubber feet.

Continue on page following illustrations.

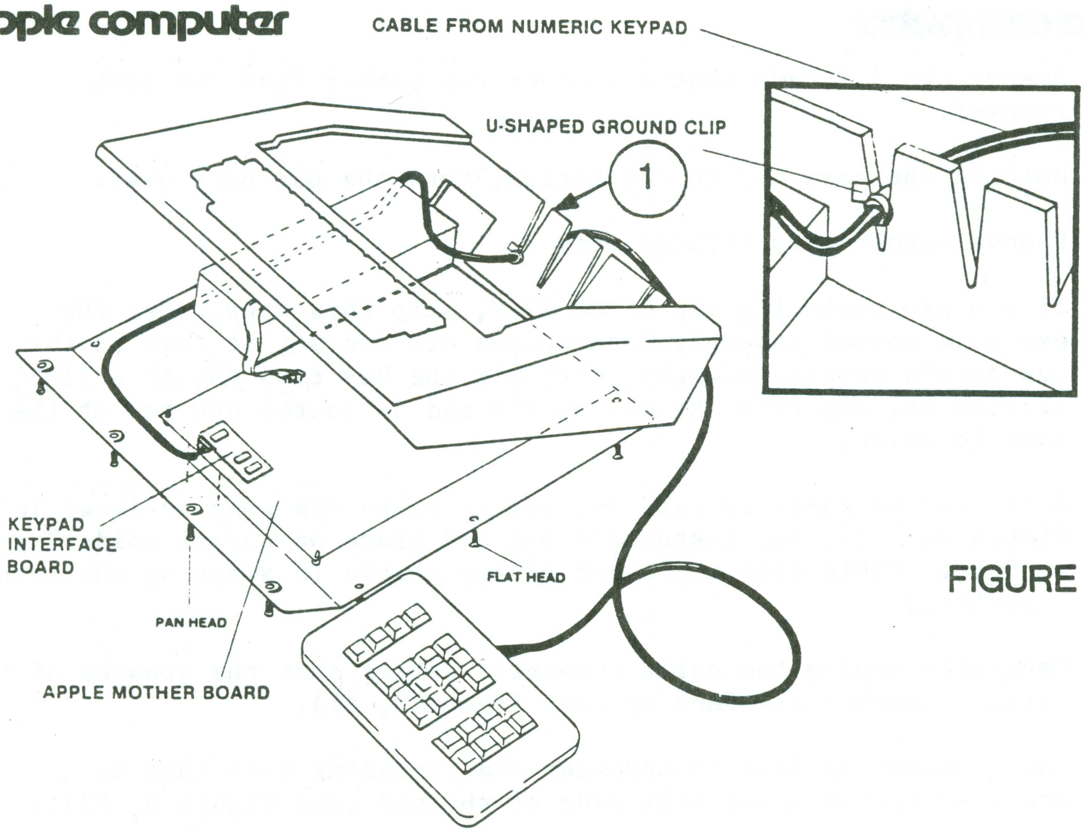


FIGURE E

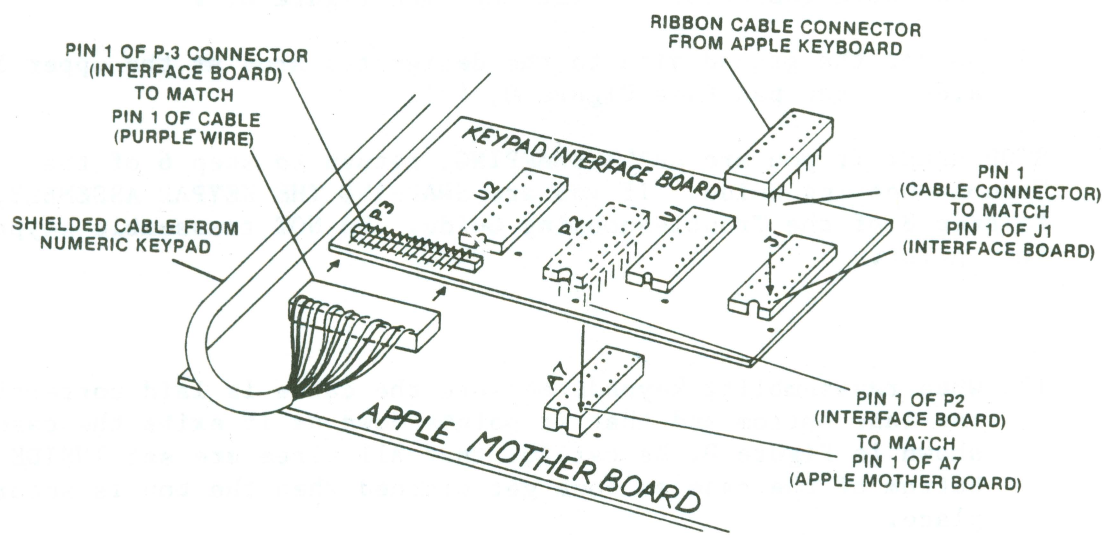


FIGURE F

apple computer

RECONNECTING KEYPAD TO APPLE

15. Complete these steps to reconnect numeric keypad to Apple.

    a. Set housing back on Apple base (do NOT set screws in place yet!)
    b. Thread the cable through a notch in the rear of your Apple.
    c. Slide the little u-shaped ground clip on the cable down the edge of the notch to secure the ground to the Apple case. (see Figure E, #1)
    d. Plug interface board connector P2 into mother board socket at A7. Be sure to match up P2 pin 1 to A7 pin 1. Plug keyboard connector into keypad interface board connector J1. Be sure to match up pin 1 - J1 to pin 1 keyboard connector. (see Figure F)
    e. Holding both base and housing, turn Apple upside down so keyboard rests on foam pad.
    f. Install four lock washers and pan-head screws at front of base.
    g. Install six flat-head screws at three outside edges of Apple base.
    h. Turn Apple right side up, reinstall lid, and reconnect other cable connected items and the power cord to Apple.

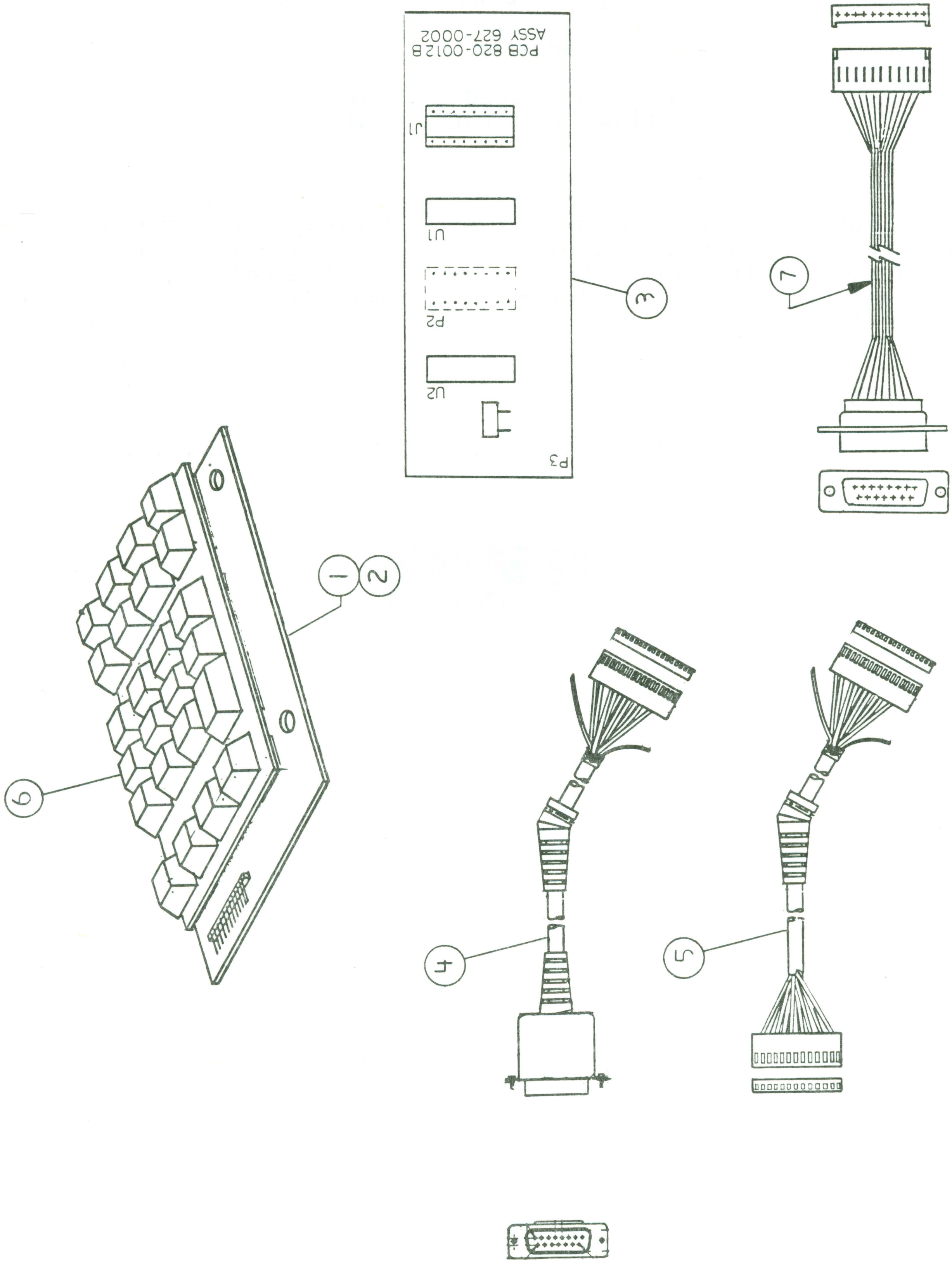
Numeric Keypad Technical Procedures

Section 2

Numeric Keypad II, IIe
Illustrated Parts List

The figures and lists below include all piece parts that can be purchased separately from Apple for the Numeric Keypad, along with their part numbers. These are the only parts available from Apple. Refer to your Apple Service Programs manual for prices.

Contents:


ASSY 627-0002
PCB 820-0012B
J1
U1
P2
U2
P3
1
2
3
4
5
6
7

NUMERIC KEYPAD II, IIe

Item	Part No.	Description
1	661-0314	Numeric Keypad Assembly, II, with cable
2	658-4040	Numeric Keypad Assembly, IIe
3	658-0005	Assy, PCB, Interface Keypad II
4	590-0130	Cable, Numeric Keypad IIe
5	590-0119	Cable, Numeric Keypad II
6	658-7008	K'cap Set, Numeric Keypad II
7	590-0129	Interconnect Cable, Numeric Keypad IIe

The following keyswitches are illustrated in **Appendix A:**

705-0070	Alps Long Stem Keyswitch
705-0075	SMK Keyswitch Short Stem

The parts list for the Macintosh Numeric Keypad can be found in the **Macintosh Technical Procedures, Section 5, Illustrated Parts List.**

apple computer

Numeric Keypad Technical Procedures

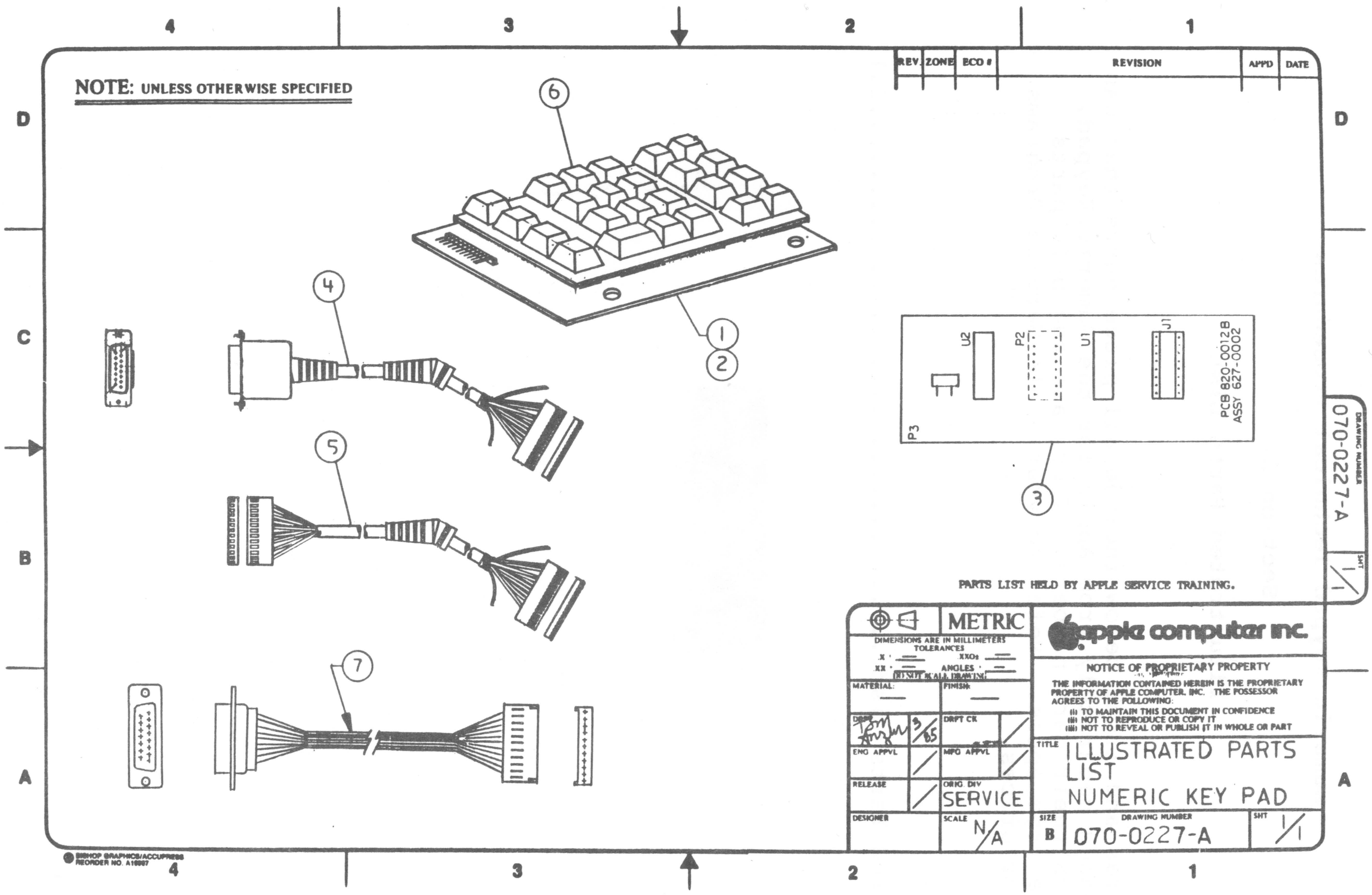
Section 2

Illustrated Parts List

The figures and lists below include all piece parts that can be purchased separately from Apple for the Numeric Keypad, along with their part numbers. These are the only parts available from Apple. Refer to your Apple Service Programs manual for prices.

Contents:

Numeric Keypad



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NUMERIC KEYPAD

Item	Part No.	Description
1	661-95092	Numeric Keypad Assembly, II
2	658-4040	Numeric Keypad Assembly, IIe
3	658-0005	Assy, PCB, Interface Keypad II
4	590-0130	Cable, Numeric Keypad IIe
5	590-0119	Cable, Numeric Keypad II
6	658-7008	K'cap Set, Numeric Keypad II
7	590-0129	Interconnect Cable, Numeric Keypad IIe

The following items can be found in the Macintosh section of the Technical Procedures Binder:

590-0144	Keyboard/Keypad Cable, Macintosh
658-4045	Macintosh Keyboard

The following keyswitches can be found in the Keyboard section of the Technical Procedures Binder:

705-0070	Alps Long Stem Keyswitch
705-0075	SMK Keyswitch Short Stem

Numeric Keypad Technical Procedures

Appendix A

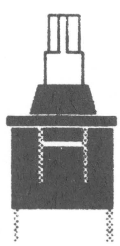
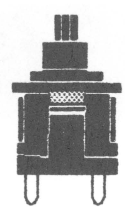
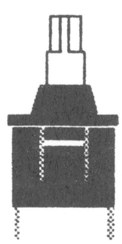
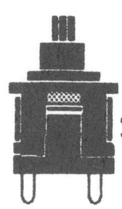
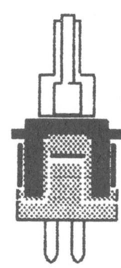
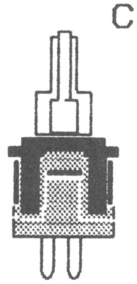
Keyboard and Keyswitch Identification

Apple Computer makes three types of numeric keypads, one each for the Apple II, IIe, and Macintosh. To identify the keyswitches used with these keypads, refer to Figure 1 below.

Some of the keyswitches are used on more than one numeric keypad: For example, Alps long stem is used on both the Apple IIe and Macintosh numeric keypads.

The procedure to replace a keyswitch is in section 3 of "You Oughta Know". For information about Macintosh numeric keypads, go to the Macintosh section of the Technical Procedures Binder.

FIGURE 1:

Keyswitch	Keyboards
A. Apple II Numeric Keypad  (Obsolete)  705–0075 SMK Short Stem Keyswitch	Apple II Keypad Service Number: 661–95092
B. Apple IIe Numeric Keypad  (Obsolete)  705–0075 SMK Short Stem Keyswitch  705–0070 Alps Long Stem ("Extended")	Apple IIe Keypad Service Number: 658–4040
C. Macintosh Numeric Keypad  705–0070 Alps Long Stem ("Extended")	Macintosh Keypad Service Number: 658–4045

Macintosh Office

APPLE LASERWRITER PRINTER
INTRODUCTORY TECHNICAL PROCEDURES

TABLE OF CONTENTS

CONTINUED ON NEXT PAGE

Section 2, continued

Lower Main Body of Printer

Section 3 - Adjustments

Section 4 - Troubleshooting

Contents:

CONTINUED ON NEXT PAGE

Section 4, continued

GENERAL INTRODUCTION: THIS MANUAL

The service procedures contained in this manual will tell you how to repair the major problems that may occur in the first few months of sales of the Apple® LaserWriter Printer. **This is not the complete Level I Technical Procedures manual for the printer:** you can receive that manual only after attending the Macintosh™ Office Training. The present manual is intended to help you deal with printer emergencies that may come up before you attend training. It is meant to be used along with the videotape LaserWriter Printer Introductory Service Procedures.

Installation instructions for the LaserWriter and the AppleTalk™ Personal Network are given in the Macintosh Office Quick Reference Guides and the videotape Macintosh Office Setup and Operation. **Familiarize yourself with those materials before using this manual.**

Also familiarize yourself with the LaserWriter user's manual. It contains instructions on use and operator-level maintenance of the printer which all service personnel should be aware of.

In this manual, read section 1, **Basics,** before doing any work inside the printer. It explains how the printer works and gives diagrams locating the major assemblies in the printer. It also explains the printer's test prints and status lights and gives specifications for printer use and maintenance.

Sections 2 and 3, **Take-Apart** and **Adjustments,** contain step-by-step instructions for the replacements and adjustments that you may need to perform before you take the LaserWriter training course. If you need to perform one of these procedures at a customer's site, watch the videotape and try the procedures first on the demonstration model LaserWriter at your own shop.

Section 2 also contains **important safety information and Electrostatic Discharge precautions** that you need to know before working inside the printer. **Don't ignore these precautions. The printer's laser light can damage your eyes severely unless you observe the safety precautions, and static discharge can cause real problems with expensive printed circuit boards.**

Section 4, **Troubleshooting,** is also an abbreviated section. It refers only to the repair procedures given in this introductory manual. If you cannot solve a LaserWriter problem using the Troubleshooting section in this manual, contact your regional support center.

Apple LaserWriter Printer
Introductory Technical Procedures

Section 1 - Basics

Contents:

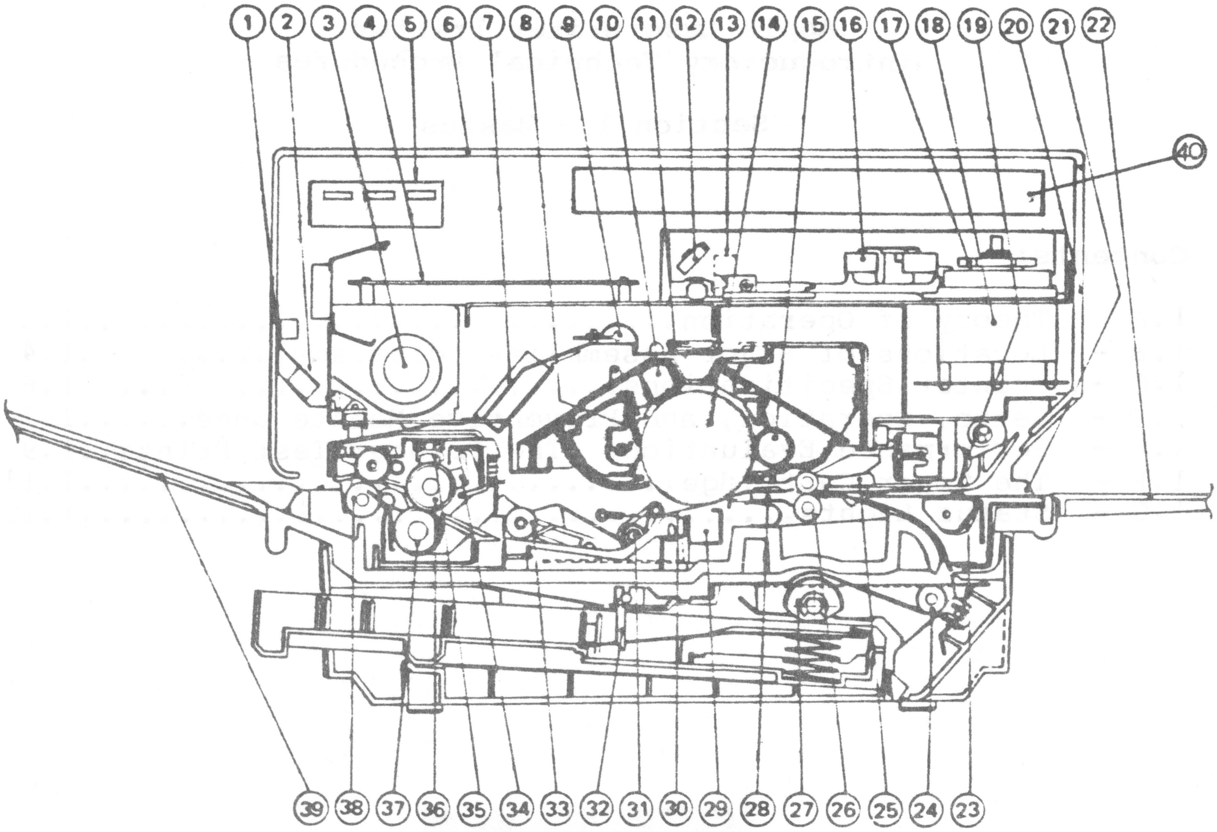


Figure 1-1 : Cross Section of the Printer (Front View)

1. LEFT PANEL
2. Duct
3. Fan
4. DC controller PCB
5. Display panel
6. Top cover
7. Ozone filter
8. Cleaning blade
9. Preconditioning exposure lamps
10. Primary corona assembly
11. Laser beam-blocking shutter
12. Beam-to-drum mirror
13. Stationary mirror
14. Photosensitive drum
15. Developing cylinder
16. Focusing lenses
17. Scanner mirror
18. Scanner motor
19. Upper manual pickup roller
20. RIGHT PANEL
21. Manual paper feed guide
22. Manual feed tray
23. Lower manual pickup roller
24. Cassette feed roller
25. Registration shutter
26. Feeder roller
27. Cassette pickup roller
28. Transfer guide assembly
29. Transfer corona assembly
30. Separation belt
31. Separation feeder unit
32. Paper detection arm
33. Feeder (pinch) roller
34. Thermistor
35. Fuser roller cleaner felt
36. Upper fuser roller
37. Lower fuser roller
38. Delivery roller
39. Print tray
40. LaserWriter I/O board

1.A - THEORY OF OPERATION

The LaserWriter printer uses laser light, a sophisticated optical system, and a plastic powder called **toner** to produce its images. Using a dot matrix of 300 dots per inch (6.8 million per page), it can produce a variety of high-quality print fonts and graphics, either separately or on the same page. Computers can be connected to the printer either through the AppleTalk network or through the RS232/422 port.

The **LaserWriter I/O board** controls communications between the printer and external computers. It contains 1.5 megabytes of RAM and 500 kilobytes of ROM, plus a 68000 microprocessor. During printing, when a document is sent to the printer from an attached computer, the I/O board receives a description of each page in a language called PostScript˜. (ASCII files can also be accepted, but this discussion will be confined to normal printing from a Macintosh.) It then converts the PostScript commands into a bit image which it stores in RAM and then sends to the printer's **DC Controller board.** The DC Controller board controls the operation of the print mechanism and the **laser/scanner unit** to produce the actual printed page.

The semiconductor **laser** produces a beam of infrared light which is directed toward a rotating hexagonal mirror in the **scanner unit.** The scanner mirror reflects the beam across a revolving light-sensitive **drum** in the **Toner Cartridge.** As the drum rotates, the result is a raster scan, very much like that which forms the picture in a television set.

The drum is given a positive charge by the **primary corona wire** inside the toner cartridge. Wherever the light beam hits the drum, it neutralizes this positive charge on a tiny "dot" on the drum's surface. The pattern of dots produced by the laser's beam forms the image.

After being exposed to the laser scan, the drum rolls through the toner powder, which is contained in the same unit (the toner cartridge). The toner is positively charged, so it avoids the positive ("white") areas of the drum surface, but is attracted to the neutral (slightly negative) dots where the laser beam has struck the drum.

The drum, with its load of toner, then comes in contact with the paper. At this point, the paper is given a strong negative charge by the **Transfer Corona Wire.** This negative charge causes the toner to stick to the paper. As the paper travels forward, it is stripped off the drum by the **separation belt.** It then passes between two heated rollers in the **Fuser Assembly,** and the combination of heat and pressure fuses the toner onto the paper permanently.

1.B - LOCATIONS OF MAJOR ASSEMBLIES

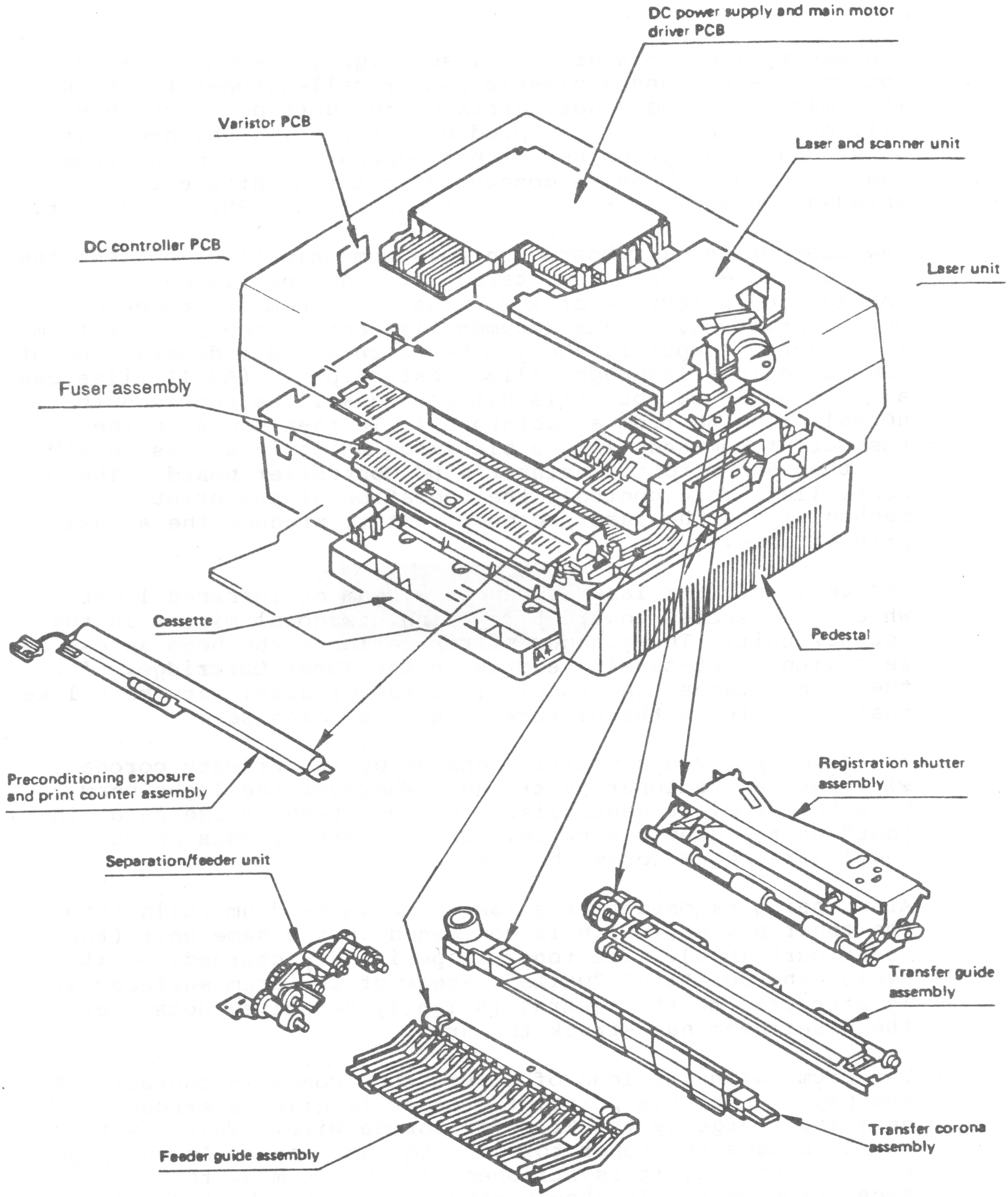


Figure 1-2

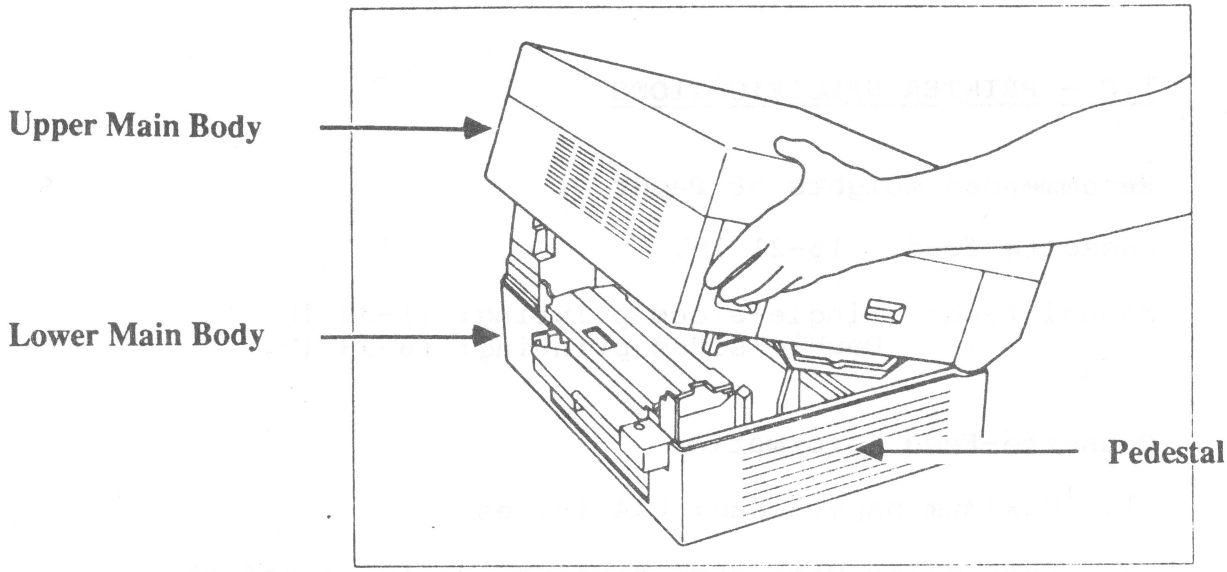


Figure 1-3

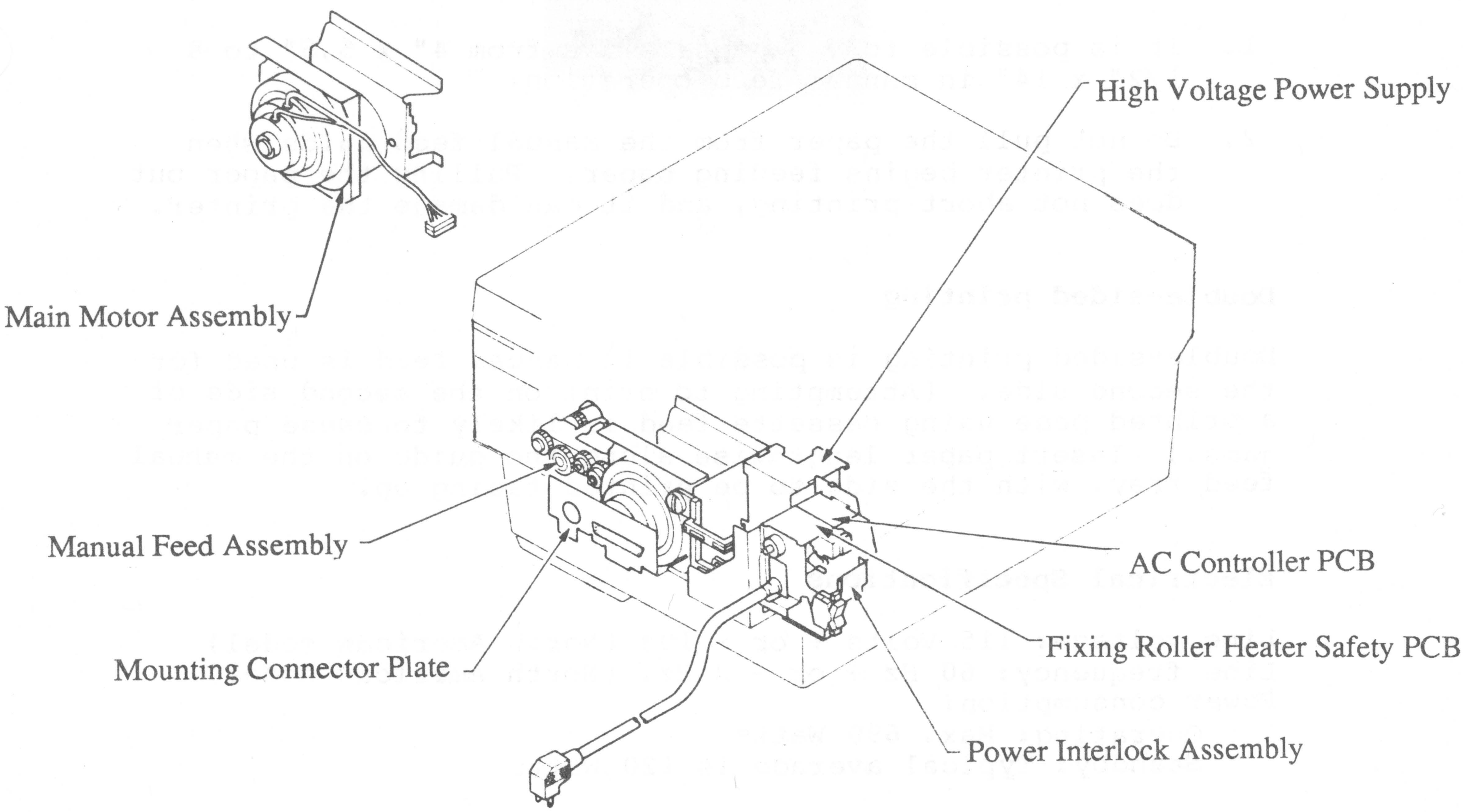


Figure 1-4

1.C - PRINTER SPECIFICATIONS

Recommended Weights of Paper

Cassette feed: 16-21 lb.

Manual feed: Single-sided printing: 11-33 lb.
Double-sided printing: 16-33 lb.

Cassette-Feed Information

1. Maximum paper load: 0.4 inches

2. Load paper with curl-side up, as in an office photocopier. Before loading paper, fan through the stack to ensure proper feeding.

3. Store paper in its package in a dry location. Do not open a package of paper until you are ready to use it.

Manual-Feed Information

1. It is possible to use paper sizes from 4" x 5.5" to 8 1/2" x 14" in manual feed operation.

2. Do not pull the paper from the manual feed guide when the printer begins feeding paper. Pulling the paper out does not abort printing, and it can damage the printer.

Double-sided printing

Double-sided printing is possible if manual feed is used for the second side. (Attempting to print on the second side of a printed page using cassette feed is likely to cause paper jams.) Insert paper lengthwise along the guide on the manual feed tray, with the side to be printed facing up.

Electrical Specifications

Line voltage: 115 Volts + or - 10% (North American model)
Line frequency: 60 Hz + or - 2 Hz. (North American model)
Power consumption:
Operating: Max. 690 Watts
Standby: Typical average is 120 Watts

Environment

1. Temperature: 50° F to 90.5° F.

2. Humidity: 20% to 80% relative humidity for optimum performance.

1.D - SETUP, OPERATION, AND PREVENTIVE MAINTENANCE

Setup and operation instructions for the LaserWriter are given in the Macintosh Office Quick Reference Guides. They include the following topics:

1. Planning an AppleTalk network installation.
2. Setting up AppleTalk.
3. LaserWriter Components
4. Setting Up the LaserWriter: includes installing the toner cartridge and its cleaning pad, the paper trays, and the paper cassette.
5. Connecting devices to AppleTalk.
6. Using the Macintosh Office to Print: includes installing LaserWriter software on an application disk, fixing a "disk full" condition, and printing a document.
7. Print Quality Guide: a preventive maintenance and troubleshooting guide for users.

The Quick Reference Guides can help you guide users over the telephone in troubleshooting problems that users can fix on their own.

Operator-level preventive maintenance instructions are given in the LaserWriter user's manual. They include instructions for the following:

1. Replacements:

   a) the separation belt.
   b) the toner cartridge and its cleaning pad (fuser roller cleaner).

2. Cleaning:

   a) the transfer corona wire
   b) the transfer guide
   c) the primary corona wire in the toner cartridge
   d) the fuser assembly rollers, and
   e) the separation belt.

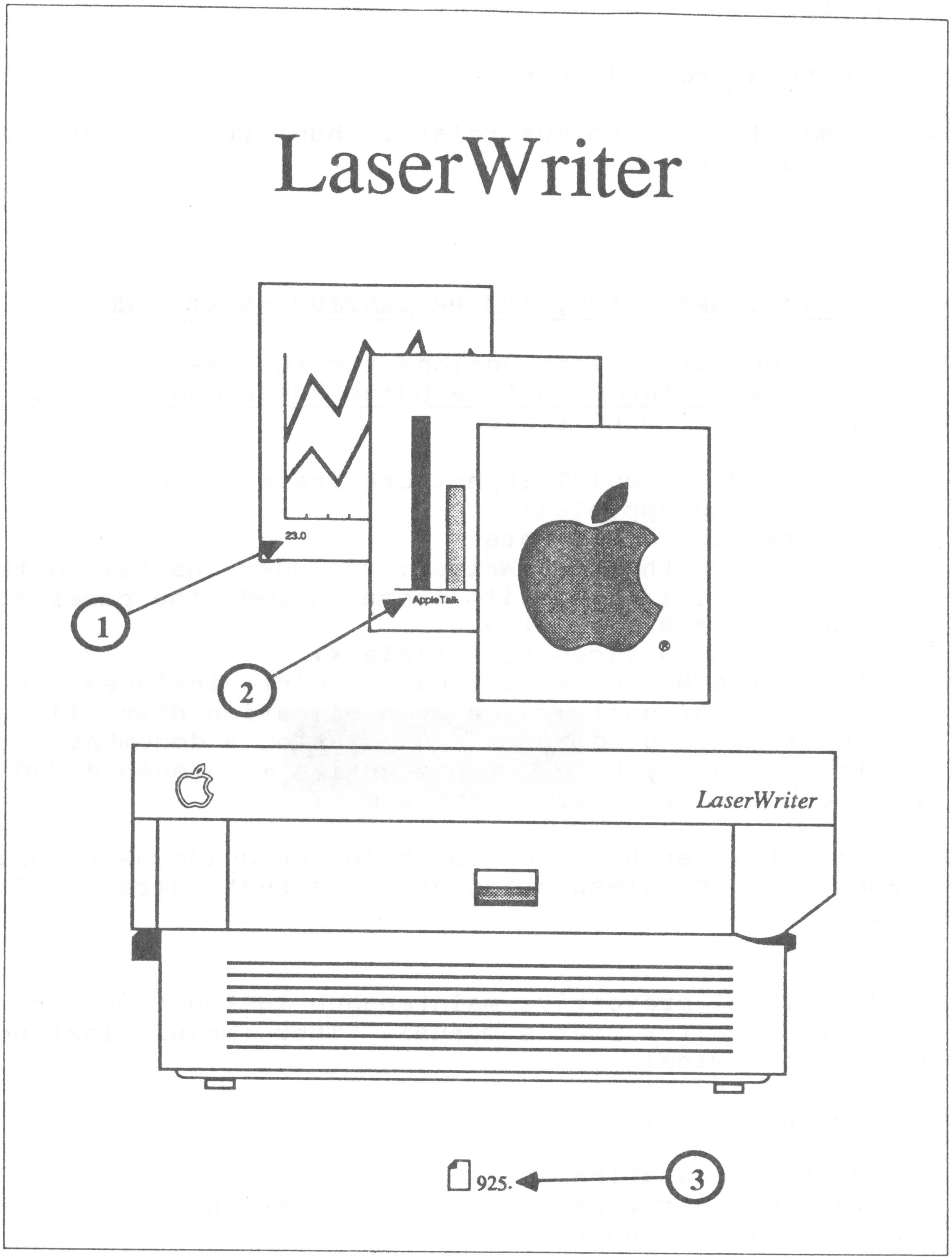


Figure 1-5 : User Test Print

1.E - PERFORMANCE EVALUATION: THE PRINTER TEST PRINTS

The LaserWriter has two test prints. The service test print can be produced by jumpering two pins on the DC Controller board. This print exercises the LaserWriter's printing functions but does not involve the LaserWriter I/O board. It is useful in service situations where a test print is required but the I/O board has been removed. Instructions for generating this print are given in the body of the manual where appropriate. The print consists of black stripes on a white background, covering the entire printing area of the page. (See **Image Skew Adjustment** for further information.)

The **user test print**, reproduced in Figure 1-5, is produced each time the printer's power switch is turned on. This test print exercises the LaserWriter I/O board and contains several types of information about the printer's performance. The numbered items below refer to the numbered arrows in Figure 1-5.

1. The number printed here indicates the revision level of the printer's ROM.

2. This square indicates the setting of the selector switch at the rear of the printer. If the selection is not "AppleTalk," the Baud rate appears at the top of the bar graph and the I/O port being used (9-pin or 25-pin) is specified at the bottom of the graph.

3. This number represents the number of pages printed so far on this printer.

Aside from these items, the user test print can also tell you:

1. whether the printer is functioning: If the user test print is produced without problems, the printer is working correctly.

2. whether the image is properly aligned to the paper: by measuring from the square border to the edge of the paper, you can tell whether the image is tilted further than is acceptable according to Apple's specifications. (See "Image Skew Adjustment" in Section 3.)

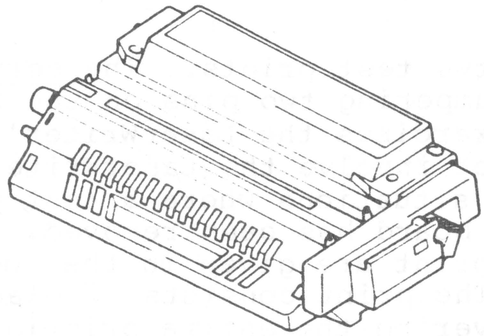


Figure 1-6 : Toner Cartridge

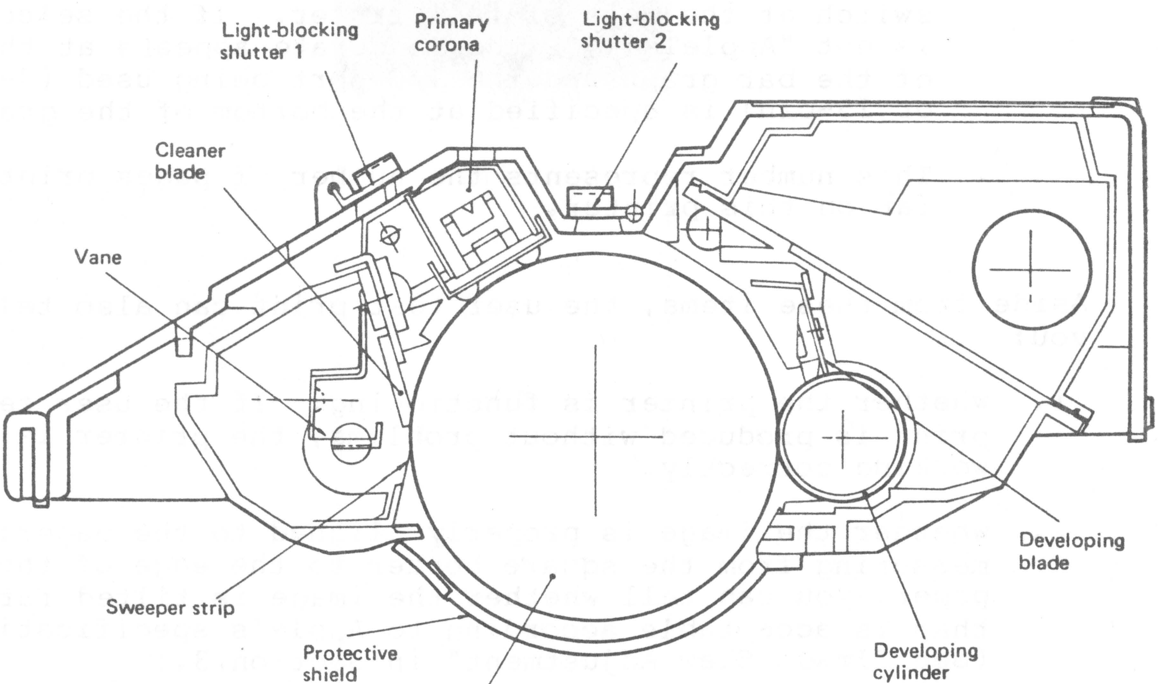


Figure 1-7 : Toner Cartridge (Cross-Section)

1.F - THE TONER CARTRIDGE

The toner cartridge (Figures 1-6 and 1-7) is a self-contained unit that includes the photosensitive drum, the primary corona wire (which charges the drum), a developing unit, toner hopper, and drum cleaner (see Figure 1-7). The cartridge cannot be disassembled.

The printing life of a cartridge is approximately 3,000 pages, but may vary according to the type of printing done: for instance, graphics that include large black or shaded areas will use more toner than ordinary text.

a. Protective Shield

The toner cartridge has a protective shield over the area where the paper comes into contact with the drum. When the cartridge is removed from the printer, this shield shuts automatically, preventing light from entering. (If the drum is exposed to light, blank areas and faint black stripes may appear on prints.)

The shield is opened automatically when the toner cartridge is inserted into the printer and the printer is closed. Do not open the shield manually unless necessary, and do so only in dim light.

b. Light-blocking Shutters

The two light blocking shutters protect the areas where the preconditioning lamps "erase" the drum surface and where the laser beam "paints" the image on the drum. These shutters open automatically when the cartridge is inserted into the printer. If the shutters do not close by themselves when you remove a cartridge from the printer, close them manually.

c. Storage

1. The toner cartridge should be stored at a temperature between 32 and 95 degrees F in a relative humidity of 35% to 85%. Higher or lower temperatures or humidities may reduce the storage life of the cartridge, as will storage in air pressure lower than 0.6 atmospheres or higher than 1 atmosphere.

   NOTE: The expiration date of the cartridge is specified on the cartridge box. The usable lifetime of a toner cartridge is 2 1/2 years from the date of manufacture. Cartridges more than 2 1/2 years old may give poor print quality.

2. Do not place cartridges in direct sunlight or near a window. Do not leave them inside an automobile for a long period in warm weather, even if the cartridges are still in their storage boxes.

3. Avoid storing cartridges in places where the temperature or humidity may change suddenly (for example, near an air conditioner or heater).

4. Avoid storing cartridges in dusty locations and places where they might be exposed to ammonia fumes or organic solvents. (Inform your cleaning staff not to use ammonia near the printer or near stored cartridges.)

d. Handling Suggestions

1. When installing a cartridge, hold it horizontally and rock it slowly back and forth 45°, to distribute the toner. (See Figure 1-8.)

2. If white areas occur on prints due to lack of toner, rock the cartridge back and forth to redistribute the toner. This can sometimes coax extra life out of a cartridge that is almost empty.

   CAUTION: To avoid toner spillage after a toner cartridge's seal is broken, hold it by the handle and rear only, as shown in Figure 1-8.

3. Never touch the surface of the photosensitive drum. If the surface of the drum becomes dirty, open the protective shield and wipe it clean with a piece of flannel that has been liberally sprinkled with toner. Never wipe it with a dry cloth or paper towel, and never use solvent.

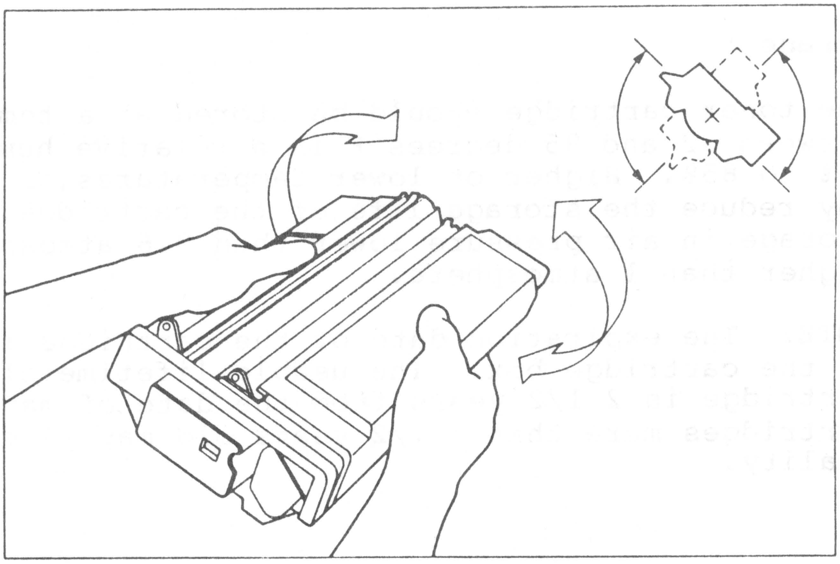


Figure 1-8

4. If the cartridge is left in strong light for a long time, white blanks or white stripes will appear on prints (even if the protective shield and shutters are closed.) If this happens, stop the printer and wait a few minutes: the cartridge should be able to "recover" within this time.

   NOTE: Normal room light, measured a few meters from a window on an average day, is about 1,500 lux. Do not expose the photosensitive drum to light of this intensity for more than 5 minutes. If the drum is placed under these conditions accidentally, the cartridge can be stored in a dark place to "recuperate," although an image may be retained on the drum for some time. Direct sunlight is 10,000 to 30,000 lux. A drum exposed to direct sunlight may be ruined.

1.G - STATUS LIGHTS

The printer has four status lights, three on the display panel at the front of the machine and one on the rear (I/O) connector plate.

1. The TEST light on the rear (I/O) connector plate (Figure 1-9) blinks continuously if the LaserWriter I/O board is malfunctioning. (If the board is functioning correctly, this light will blink once and then go out when the printer is turned on.)

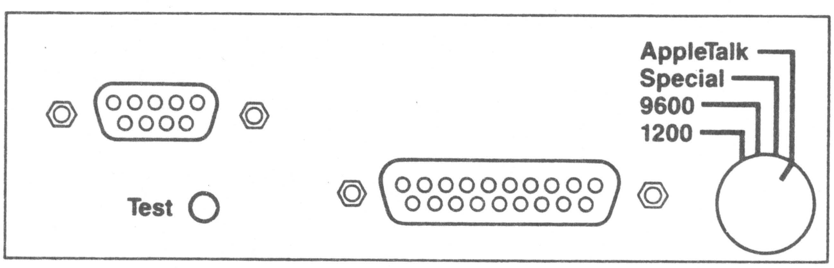


Figure 1-9 : Rear (I/O) Connector Plate

2. Display panel LEDs (Figure 1-10):

   a) The green READY light blinks while the printer is warming up and then stays on continuously when the printer is ready to operate.

   b) The yellow PAPER OUT light stays on continuously when there is no paper in the paper cassette, or when the paper cassette is not installed. This light blinks when the printer is preparing to print a page. (With manual feed, this LED lights steadily if there is no paper on the manual feed tray.)

   c) The red PAPER JAM light stays on continuously when a paper jam occurs. Printing is not possible until the jammed paper is removed.

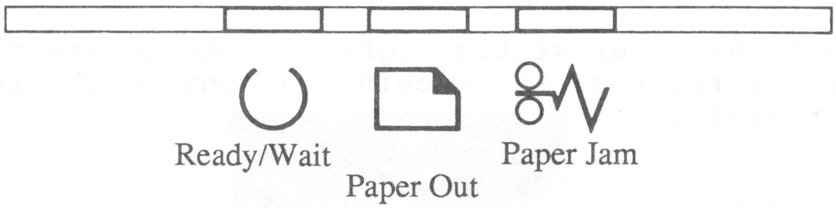


Figure 1-10 : Display panel LEDs

Apple LaserWriter Printer
Introductory Technical Procedures

Section 2 - Take-Apart

Contents:

General Information

Upper Main Body of Printer

Lower Main Body of Printer

GENERAL INFORMATION

2.A - EQUIPMENT NEEDED FOR LASERWRITER SERVICE

Phillips screwdrivers, magnetized:
- #2 head, stubby (1.25-inch shaft, 3-inch maximum total length)
- #2 head, medium (4-inch shaft)
- #2 head, long (6-inch shaft)

Long nose pliers (preferably curved)
diagonal cutting pliers
Medium flathead screwdriver (or other tool for prying)
snap-ring pliers, external, 19-30 mm
cable ties
Electrostatic discharge equipment (3M Velostat 8012 Field Service Kit or equivalent)
spring hook (optional)

2.B - MAIN SCREW TYPES USED

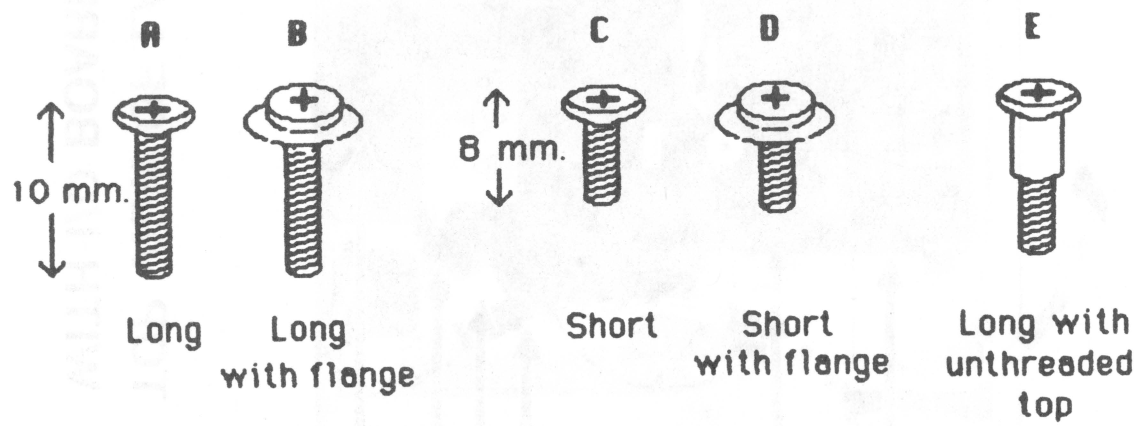
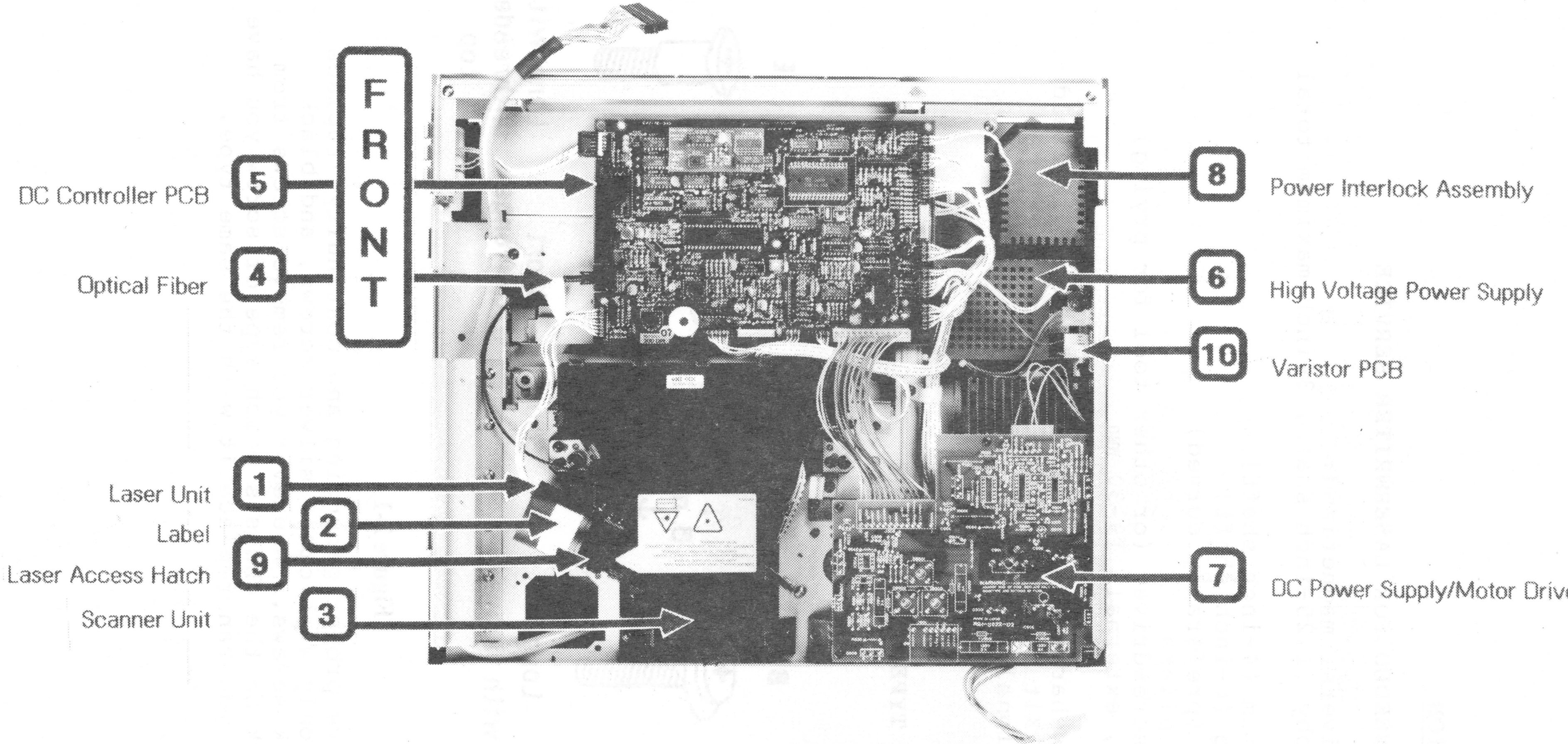


Figure 2-1

NOTE: To preserve proper grounding and continuity, replace "silver" screws only with other silver screws, and black screws with black screws. Whenever you remove screws from the printer, mark on the chassis which type of screw you have removed, so that you can replace it with the same type.



TOP VIEW OF LASERWRITER WITH I/O BOARD REMOVED

Figure 2-2

2.C - SAFETY PRECAUTIONS

1. Always unplug the printer before taking it apart, unless you are testing the electronic assemblies.

2. **Never disconnect the optical fiber (Figure 2-2, #4) from the DC Controller board when the printer is running.** The fiber carries infra-red laser radiation, which you cannot see but which can permanently damage your eyes or your neighbor's eyes. Even if you don't look directly at the fiber, the light can enter your eyes by bouncing off reflective surfaces.

3. For the same reasons, **never open the laser cover checking hatch (Figure 2-2, #9) or the scanner unit (Figure 2-2, #3) when the printer is running.**

4. The LaserWriter weighs over sixty pounds: Be careful in lifting it!

5. When the printer is running with its covers or panels removed, be careful where you put your hands. There are dangerous voltages on the DC Power Supply (Figure 2-2, #7) and the High Voltage Power Supply (Figure 2-2, #6).

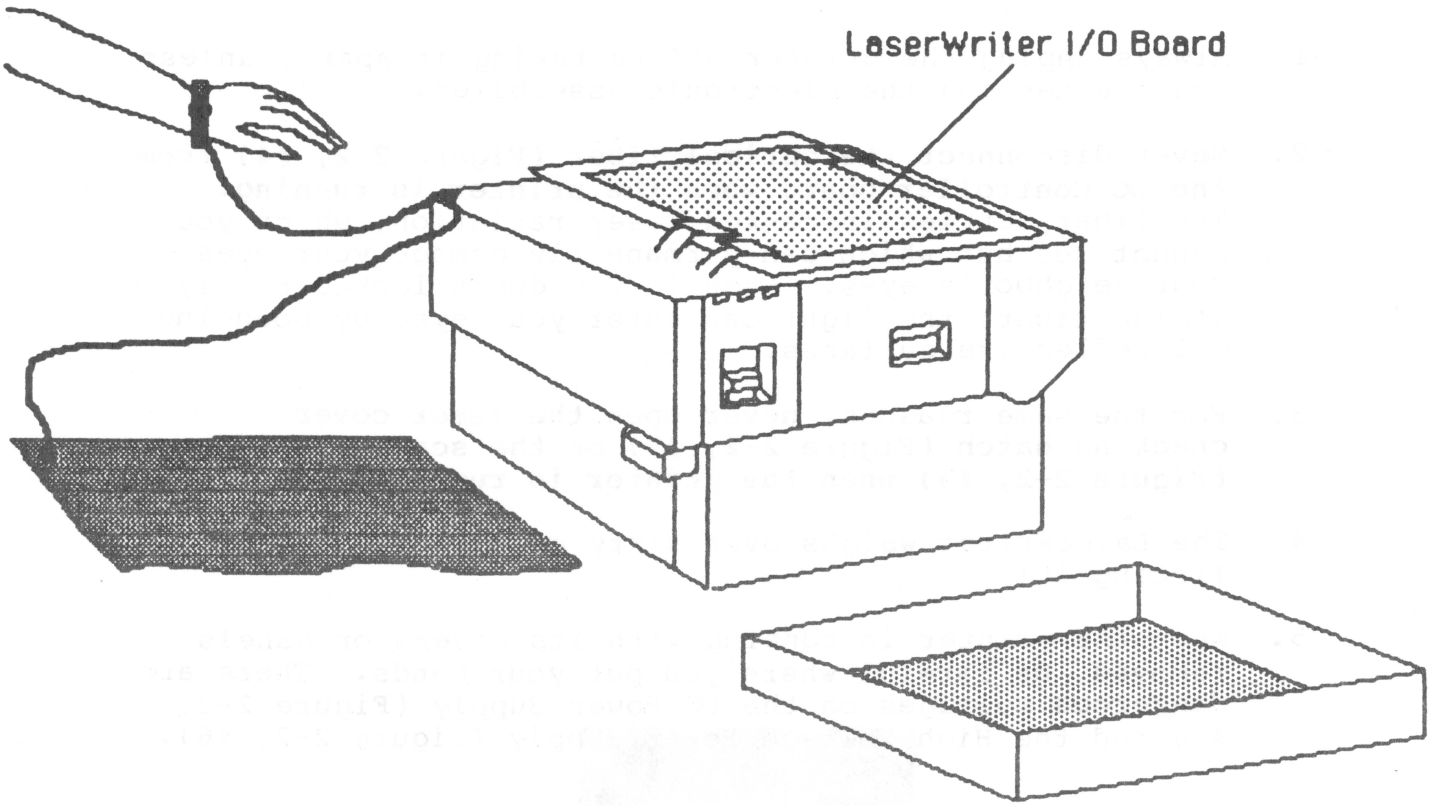


Figure 2-3

2.E - ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS

The LaserWriter I/O board (see Figure 2-3) is the most expensive single module in the printer, and its components are soldered into place. It is therefore very important to protect the chips on the board from damage. Electrostatic discharge can be an important factor in causing board failures: even if the failures are not immediate and dramatic, static zaps can degrade chips in such a way that they fail weeks or months after exposure.

To prevent electrostatic damage to the I/O board, or to any of the other boards in the machine, always ground yourself to the same potential as the printer before touching or handling the boards. This can be accomplished by using a wrist strap and grounding pad, as illustrated in figure 2-3.

Attach your wrist strap and workpad to metal surfaces on the printer chassis. The best points of contact are shiny metal surfaces, such as the nickel-plated ("silver") screws used in many places on the printer. If you are grounding yourself to an anodized (non-shiny) surface, scrape a little of the surface coating off the point of contact (in a place where it won't spoil the appearance of the printer.)

When you remove a printed circuit board, handle it by the edges only and place it directly onto the grounded workpad, or into a static-safe bag. Be sure you are grounded to the printer chassis whenever you touch the board, whether for removal or replacement.

2.E - OTHER PRECAUTIONS

1. Always remove the LaserWriter toner cartridge before removing anything else from the printer, to prevent damage to the cartridge. When you remove it, be sure the light-blocking shutters are closed, and cover the cartridge so that light will not damage it.

2. Use recommended weights and grades of paper for all tests. For best results, use 16-21 lb. paper, such as the standard paper used in office photocopiers. (See section 1.C for further paper specifications.)

3. Do not pull the paper from the manual feed guide when the printer begins feeding paper. Pulling the paper out does not abort printing, and it can damage the printer.

4. Never open the scanner unit under any circumstances: it contains optical assemblies that must be protected from dust. **Apple will not accept a scanner unit for exchange if it has been opened.**

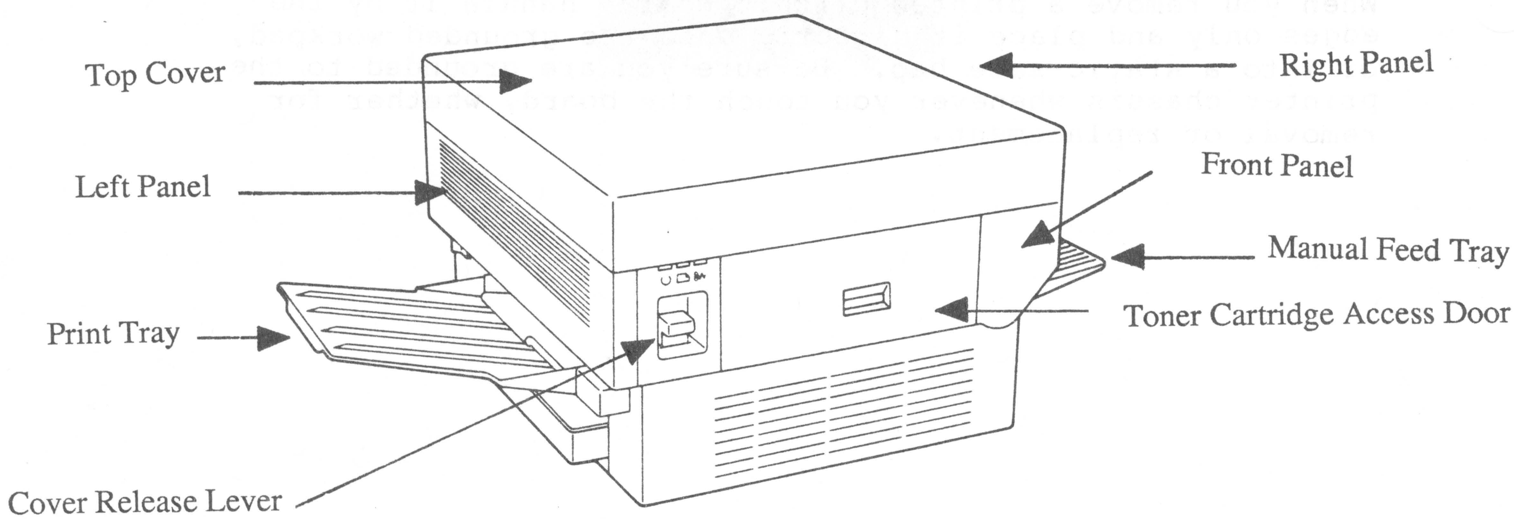


Figure 2-4

UPPER MAIN BODY OF PRINTER

2.F - COVERS AND PANELS

A. Top Cover (See Figure 2-4)

1. Open the printer (raise the upper main body by pressing up on the lever.
2. Open the cartridge access door and remove the toner cartridge. Leave the cartridge access door open.
3. Remove the two top-cover screws inside the cartridge door.
4. Remove the two screws on the other side of the top cover.
5. Lift off the top cover.

B. Front Panel

1. Open the printer and the cartridge access door. Remove the toner cartridge.
2. Remove the four screws.
3. Lift off the panel, carefully disengaging it from the case-opening lever.

C. Right Panel

1. Remove the front panel.
2. Close the printer.
3. Remove the two right-panel screws.
4. Lift off the panel.

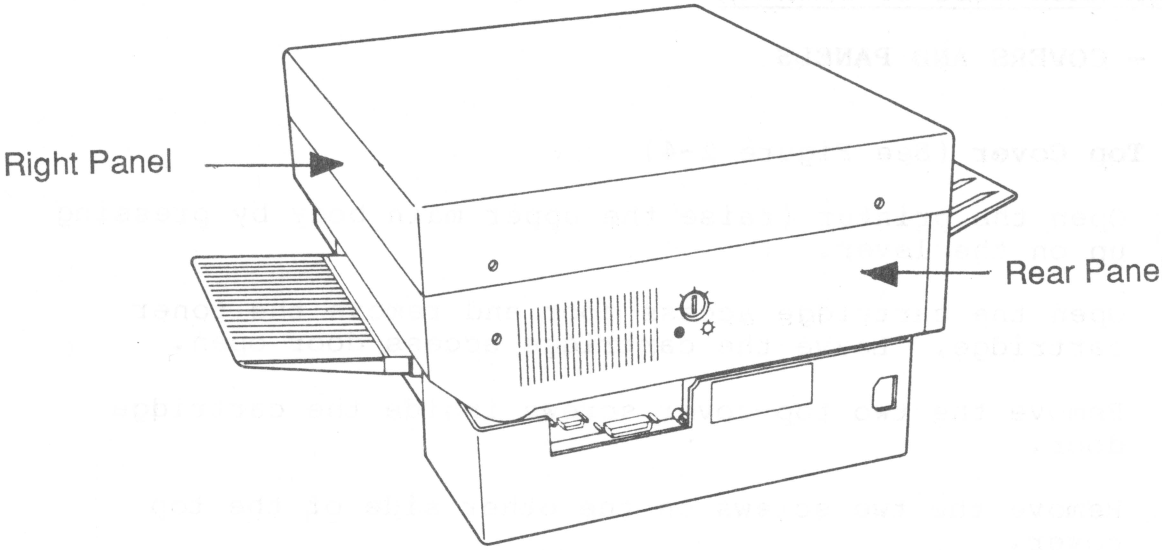


Figure 2-5

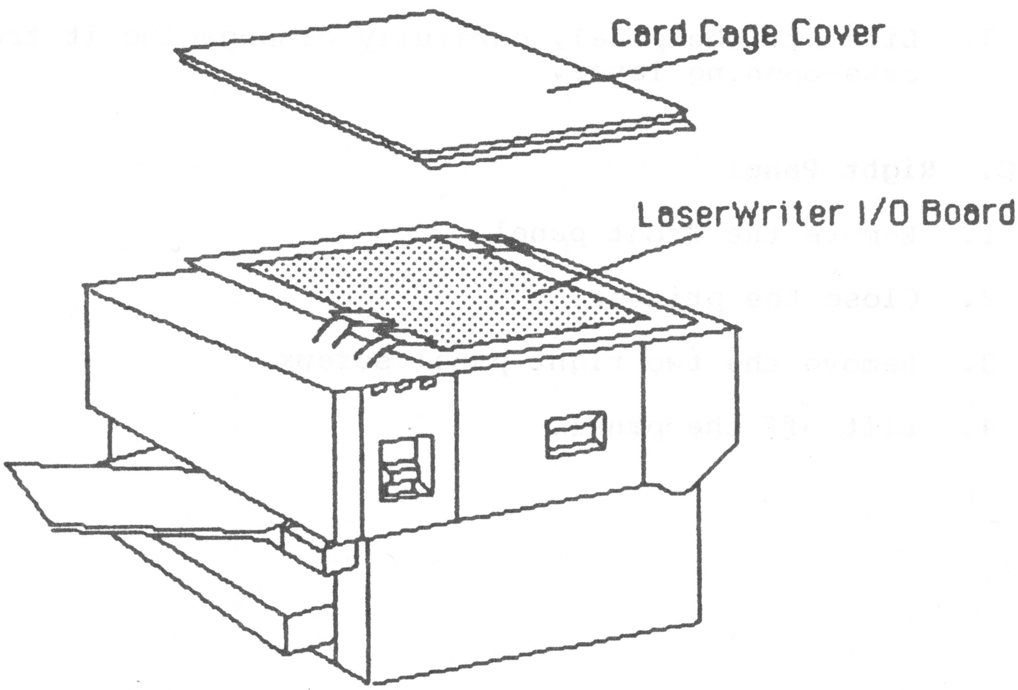


Figure 2-6

D. Rear Panel (See Figure 2-5)

1. Remove the front panel and right panel.

2. Remove the two screws and lift off the panel.

E. Left Panel

1. Remove the front, right, and rear panels.

2. Remove the four screws and lift off the panel.

To replace panels:

1. Fit the left panel on the chassis and install the four screws.

2. Do likewise for the rear panel, right panel, front panel and top cover.

   NOTE: The Apple logo on the top cover faces the front of the printer.

2.G - LASERWRITER I/O BOARD

The LaserWriter I/O board (see Figure 2-6) contains a 68000 microprocessor, 1.5 megabytes of RAM and 500K bytes of ROM. It controls communications between the printer and outside devices (computers and file servers) and contains the electronics that construct the printer's fonts.

1. Remove the Top Cover.

2. Remove the screws that hold the top of the card cage in place.

3. Lift the card cage cover off.

   CAUTION: Before touching any board, make sure you are properly grounded. **Static electricity can destroy expensive boards in an instant.**

4. Disconnect the three cables. **PULL ON THE CONNECTORS ONLY,** not on the cables.

If you are replacing the I/O board, go to step 5A. If you are removing the I/O board to gain access to other parts of the printer, skip to step 5B.

5A. To replace the I/O board:

NOTE: The I/O board is held down by plastic standoffs. On later versions of the LaserWriter, some plastic stand-offs may be replaced by metal fasteners. Remove any metal fasteners before trying to lift the board.

a) Pinch the plastic stand-offs to disengage the board.

b) Lift the board out, holding it **by the edges only,** and place it in a static-protective bag or on a workpad grounded to the LaserWriter. **Always make sure you are grounded to the LaserWriter before touching this board.**

c) Put the new I/O board into place, push it down so that the standoffs engage it, re-fasten any metal fasteners, and reconnect the three cables.

5B. **To remove the I/O board assembly to gain access to other parts of the printer**

a) Remove the screws that hold the card cage to the chassis.

b) Lift the board and card cage out carefully.

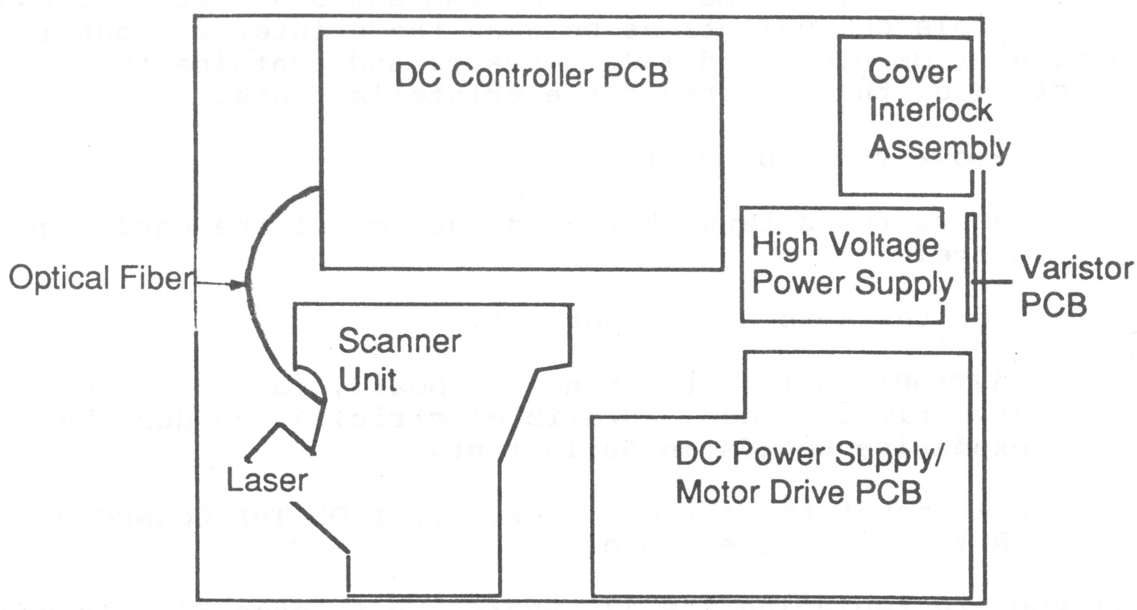


Figure 2-7: Top View with LaserWriter I/O Board Removed

2.H - DC CONTROLLER PCB

The DC Controller board (see Figure 2-7) controls most of the print functions in the LaserWriter, apart from interface functions. Replace the DC Controller board only with another Apple DC Controller board.

Remove

1. Remove top cover and LaserWriter I/O Board.

2. **CAUTION:** In this step, do not bend the optical fiber that comes from the scanner unit (see Figure 2-7). The fiber is part of the left-margin-detect circuitry. If bent, the fiber can break, and the printer will not be able to detect when the laser has reached the left margin of the page.

   <u>Unplug all the connectors on the DC Controller PCB.</u>

3. Release the board from its five nylon stand-offs and remove it.

Replace

1. Place the board on its five nylon connectors and push it down until they hold it in place.

2. Connect all cables to the board. The connectors are of different sizes: if you match them to their sockets exactly, you will have no problem. (The sockets labelled J213 and J205 are not used at this time.)

3. Reconnect the laser optical fiber and the eight-wire laser cable to the DC Controller board.

4. Replace the LaserWriter I/O Board and the top cover.

NOTE: When you install a new DC Controller Board in a printer, you must adjust the laser power. See the <u>Laser Power Adjustment</u> in **Section 3.**

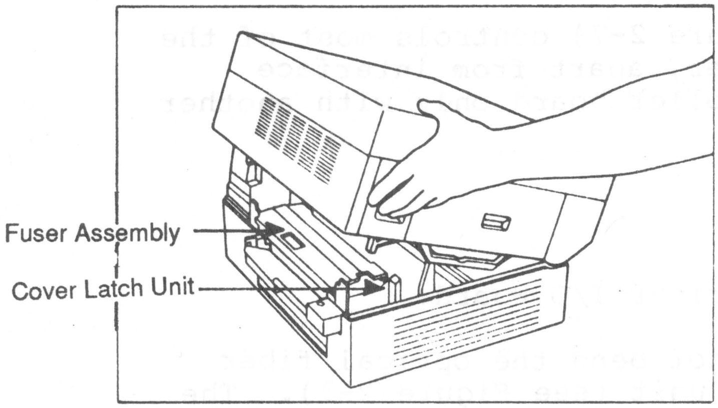


Figure 2-8

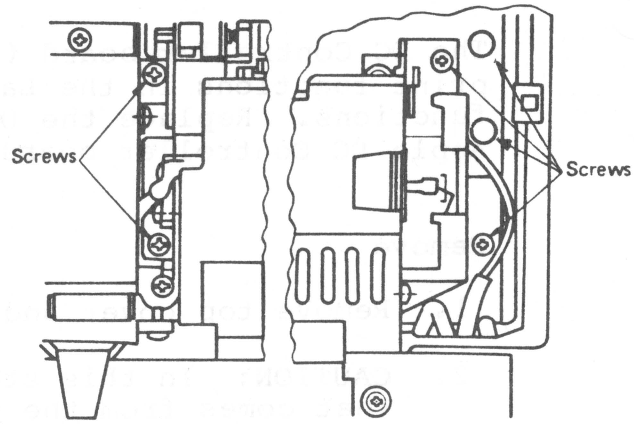
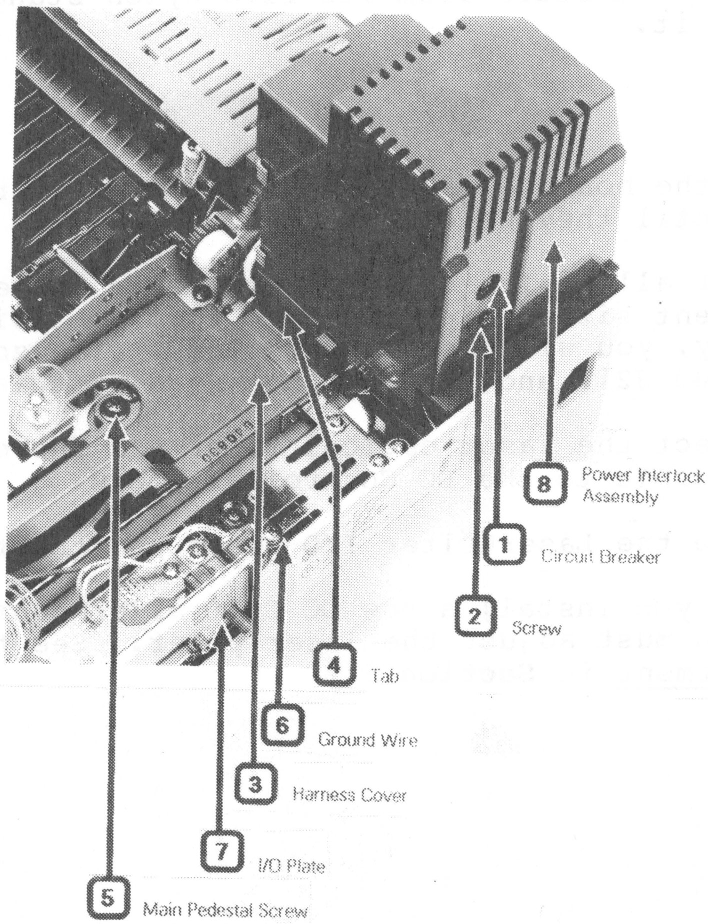


Figure 2-9



LEFT REAR CORNER OF PRINTER

Figure 2-10

2.I - FUSER ASSEMBLY (699-0306)

The fuser assembly (see Figure 2-8) contains a heater bulb inside its top roller. Pressure between the two rollers and heat from the bulb combine to melt and fuse the toner on to the paper. If the fuser rollers are worn or poorly adjusted, prints will be incompletely fixed and will smear easily.

Remove Fuser Assembly

WARNING: If the printer has been in use, the fuser assembly will be very hot. Wait until it cools down before working with it.

1. Open the printer. Open the green cover of the fuser assembly and remove the cleaning felt.

2. Remove the four black screws at the front end of the assembly (see Figure 2-9).

3. Lift out the cover latch unit (a grey plastic piece at the front end of the unit - see Figure 2-8).

4. Remove the harness cover (Figure 2-10, #3) by removing the single screw and prying back on the tab next to the Power Interlock Assembly (Figure 2-10, #4).

5. Pull out and disconnect the connector from beneath the Power Interlock Assembly.

6. Remove the two screws from the brass-colored tabs at the rear end of the fuser assembly (see Figure 2-9, left side).

7. Lift up the assembly enough to remove the spade connector on the rear end.

8. Disconnect the spade connector at the front that comes from the white plastic-sheathed wire. (It is connected to a double lug that holds a spade connector from another wire. If the lug itself comes off, work the connector from the white plastic-sheathed wire free of the lug and replace the lug on its brass lug.)

9. Lift the assembly out of the printer.

Replace Heater Bulb

CAUTION: When replacing the heater bulb, be careful. If the bulb has broken, there will be sharp glass shards in the upper roller.

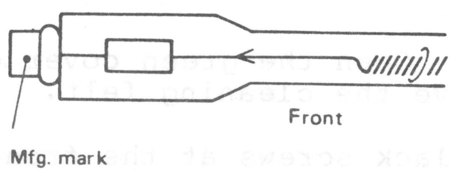


Figure 2-11

To remove the bulb:

1. Remove the black plastic end-piece from the front end of the fuser assembly by removing its two screws.

2. Carefully remove the bulb.

To install the bulb:

CAUTION: Be careful of the following things:

a) Do not touch the body of the bulb with your hands: oil from your hands can cause hot spots and weaken the bulb.

b) The glass nipple on the bulb should face downward, away from the cover of the assembly.

1. Holding the bulb by the end with the manufacturer's name (see Figure 2-11), insert it into the roller tube. Make sure that the leading end is seated on the small copper electrode at the far end of the assembly.

2. Replace the black plastic end-piece, seating its copper electrode in the end of the heater bulb. Replace the two short black screws in the end-piece.

Replace Fuser Assembly

1. Put the assembly into place.

2. Attach the spade connectors (one at either end). Make sure to tuck the wires at the front end under the lip of the assembly, so that they do not interfere with installation of the cover latch unit in step 6.

3. Reconnect the cable and tuck it beneath the Power Interlock Assembly.

4. Reinstall the harness cover and its short black screw.

5. Reinstall the two long black screws at the rear of the assembly.

6. Put the cover latch unit back into place and reinstall the four long black screws at the front of the assembly.

7. Install the cleaning felt.

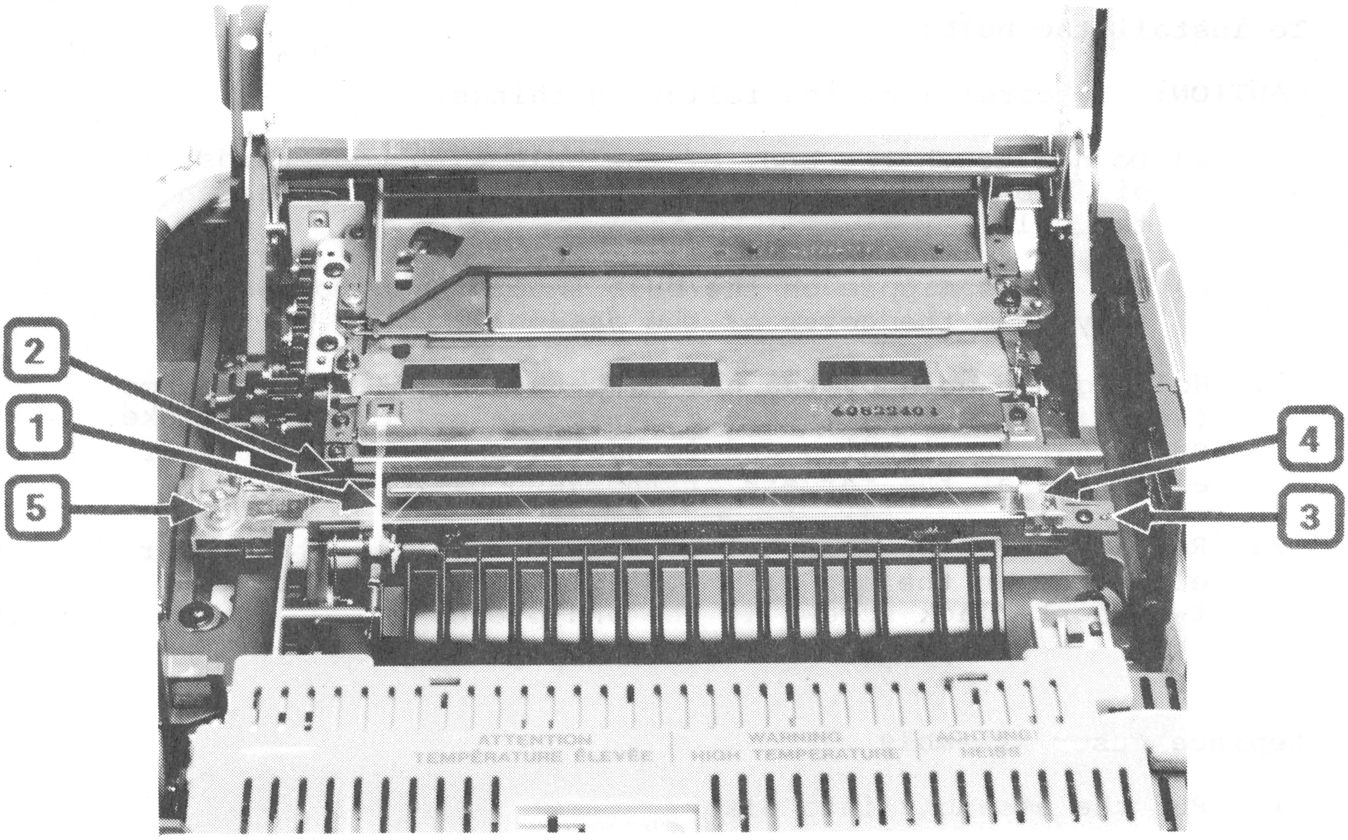

2
1
5
4
3
ATTENTION
TEMPÉRATURE ÉLEVÉE
WARNING
HIGH TEMPERATURE
ACHTUNG!
HEISS

Figure 2-12

2.J - TRANSFER CORONA ASSEMBLY

As the paper passes over the transfer corona, the corona wire gives the paper a static charge which attracts the toner from the print drum. If the corona wire breaks, the printing will be too light across the entire page. You can replace the entire assembly, or just the wire.

Remove Assembly

1. Open the printer.

2. Remove the separation belt (Figure 2-12, #1).

3. Remove the transfer roller (Figure 2-12, #2) by removing its one screw and lifting out the transfer roller.

4. Remove the screw at the front end of the transfer corona assembly (Figure 2-12, #3) and lift the assembly toward the front of the printer and out.

Replace Assembly

1. Put the assembly back into place and install the long black screw. **WARNING:** Be careful not to cut your fingers on the anti-static teeth next to the assembly: they are sharp!

2. Put the transfer roller in position (its two studs fit into holes in the brass-colored plate above it) and install its black self-tapping screw.

3. Reinstall the separation belt.

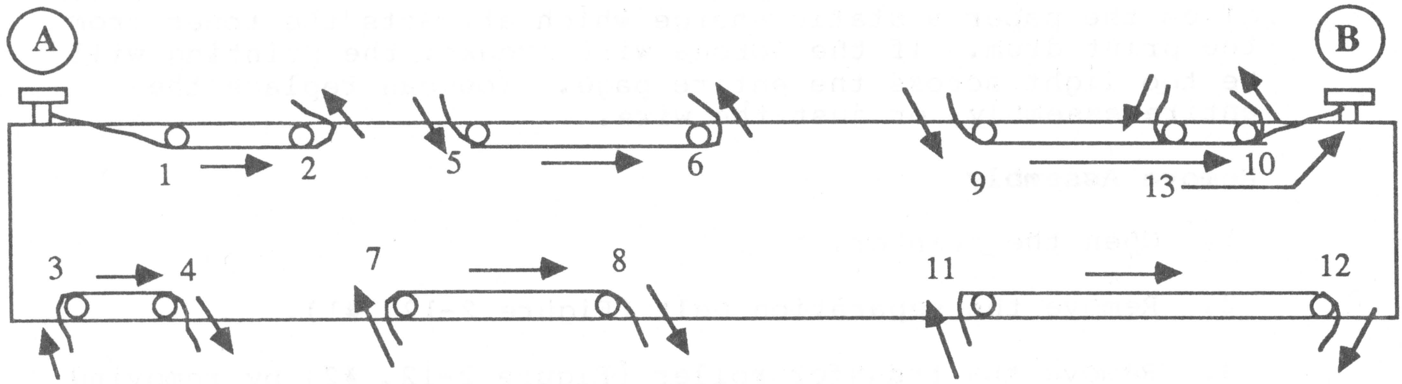
Replace Corona Wire

You will need corona wire and, for the guide wire, nylon line (4 lb. test or lighter). You will also need a spring hook, needlenose pliers, and diagonal cutters.

1. Remove the corona assembly from the laser printer.

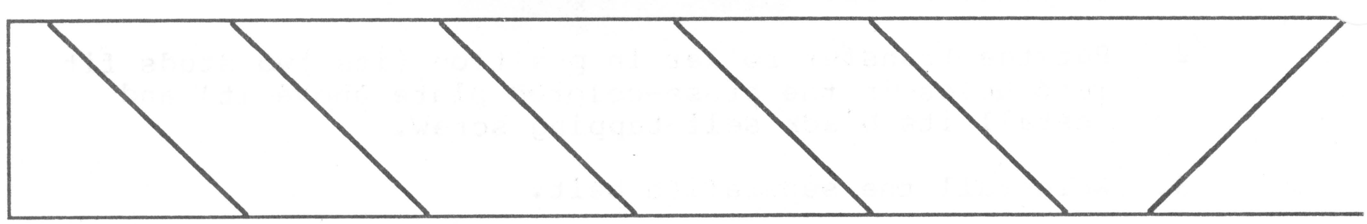
2. Place the unit in front of you so that the corona terminal (the end with the large upright screw) is on the right hand side.

3. Remove both the corona wire termination covers (Figure 2-12, #4 and 5) by unsnapping them and lifting them clear of the assembly.



CORONA ASSEMBLY -- BOTTOM VIEW

1. Fasten the guide wire with screw A.
2. Pass wire around Pin 1 and Pin 2 to Pin 3.
3. Continue routing the guide wire as shown in the diagram.
4. Pass the wire from pin 13 to screw B, and tighten screw B.



CORONA ASSEMBLY-TOP VIEW AFTER GUIDE WIRE RESTRINGING
TERMINAL END IS ON RIGHT HAND SIDE AS SHOWN

Figure 2-13

4. Remove the corona wire tension spring from the end of the broken corona wire and set it aside.

5. Remove the guide wire (nylon line) from around the corona assembly.

6. Remove the broken corona wire from the corona assembly.

7. Take the new corona wire, fold back approximately a 1/4" length, and make six to eight half-turns to form a loop at the end of the wire.

8. Hook the loop over the retaining pin on the left corona wire guide.

9. Stretch the wire along the length of the corona assembly and trim any extra length beyond the amount necessary to reach the corona wire terminal. Leave about a 1/4" margin.

10. Using the same procedure as in step #7 above, form a loop at the end of the corona wire.

11. Hook one end of the corona wire tension spring onto the loop and the other end onto the corona wire terminal.

12. Replace the corona wire termination covers.

13. Restring the guide wire as shown in Figure 2-13.

14. Replace the corona assembly in the laser printer.

Practicing on Your Own

Use your printed instructions to practice these procedures on your own demonstration model LaserWriter. To perform them in the field, you will need the LaserWriter Spares Kit. When you attend the Level I Training Course, you will learn the rest of the take-apart procedures you'll need to service the LaserWriter.

Section 3 - Adjustments

Contents:

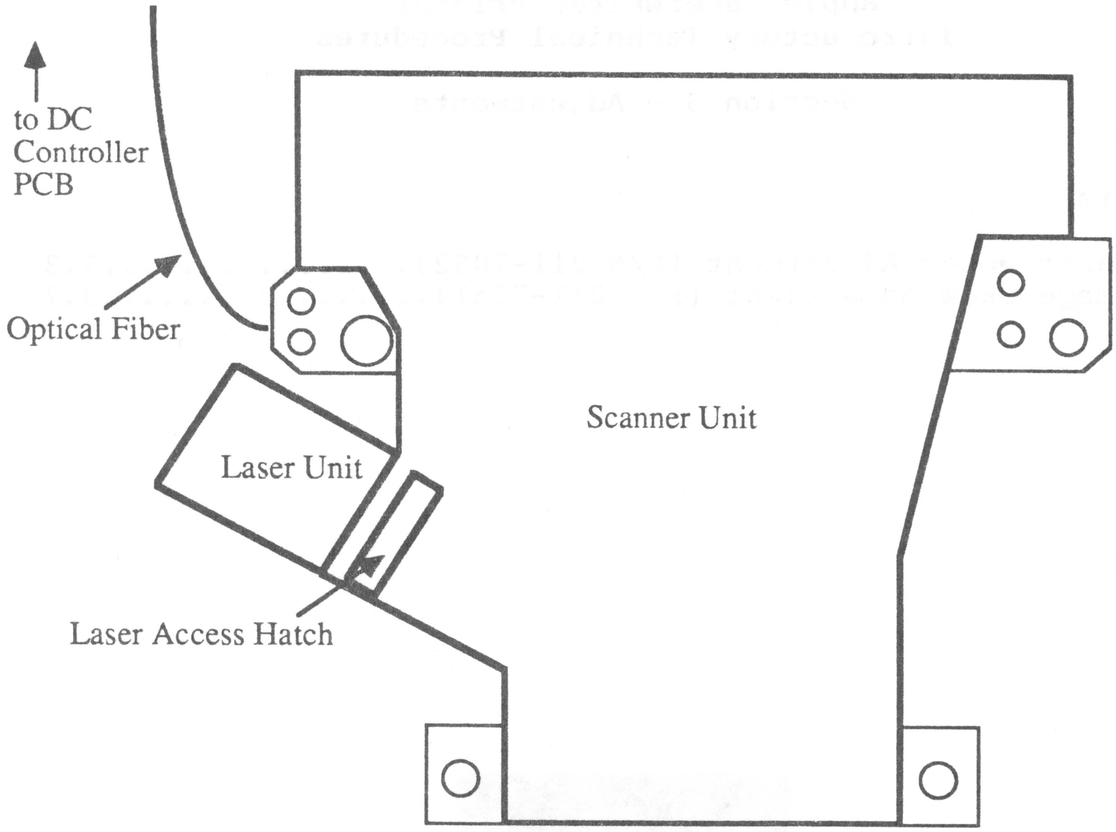


Figure 3-1

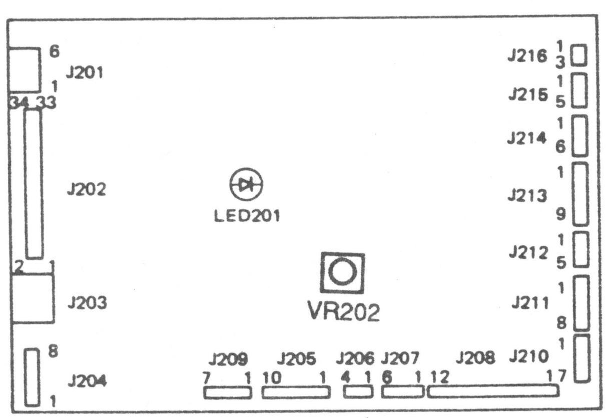


Figure 3-2 : Connector Locations on the DC Controller PCB

3.A LASER POWER ADJUSTMENT (P/N 011-7052)

Laser power should be adjusted after replacing the DC Controller board or the laser unit (see Figure 3-1). It should also be adjusted if the image is consistently too light or too dark and if that problem cannot be fixed by using the print density adjustment dial or changing the toner cartridge. (In general, however, adjust laser power as seldom as possible. Frequent adjustment increases the chances of damaging the laser chip.)

This procedure requires a multimeter and the laser power checker that comes in your LaserWriter Spares Kit.

WARNING: Review the Safety procedures in section 2 before continuing, and remove all jewelry (including dangling necklaces) before performing this adjustment.

1. **IMPORTANT: Switch the power off.**

2. Remove the top cover and the LaserWriter I/O board and card cage.

3. Open the laser access hatch on the scanner unit.

4. Insert the Laser Power Checker into the access hatch with the detector facing the laser. **WARNING:** Make sure the Laser Power Checker is fully inserted, so that none of the laser light can escape from the access hatch.

5. Connect the Laser Power Checker to a digital multimeter as follows:

   a. Connect the black lead from the Laser Power Checker to the multimeter socket marked "COMMON."

   b. Connect the red lead from the checker to the multimeter socket marked "VOLTS" or "V."

   c. Select the "VOLTS" button on the multimeter, set the multimeter range to 200mv, and turn the multimeter on.

   NOTE: If the multimeter does not make good contact, or if the meter range is wrong, the power of the laser cannot be measured accurately. Be sure the leads are plugged in correctly.

6. Disconnect the cable from J209 on the DC Controller board (see Figure 3-2).

7. Connect a jumper between pins 5 and 6 on J209.

8. If a new DC Controller board is being installed, turn VR202 (see Figure 3-2) all the way counterclockwise, to start with the lowest possible setting.

9. Switch the power on and wait about one and a half minutes for the printer to warm up. The green power light should flash during the warm-up period. You may proceed to the next step when the green light stays on steadily.

10. Momentarily connect a jumper between J209 pin 7 and pin 6; record the reading on the meter and remove the jumper. (**CAUTION:** Leaving the jumper on too long may burn out the laser.)

11. Repeat step 10 two more times. Calculate the average of the three readings to determine the laser power output.

12. Compare the averaged reading to the reading shown on the laser label (see Figure 3-3).

13. If the laser output is within the range indicated on its label (the voltage indicated next to the figure "300," plus or minus 1 millivolt), no adjustment is necessary, so you may skip the next three steps (step 14, 15, and 16) and continue with step 17.

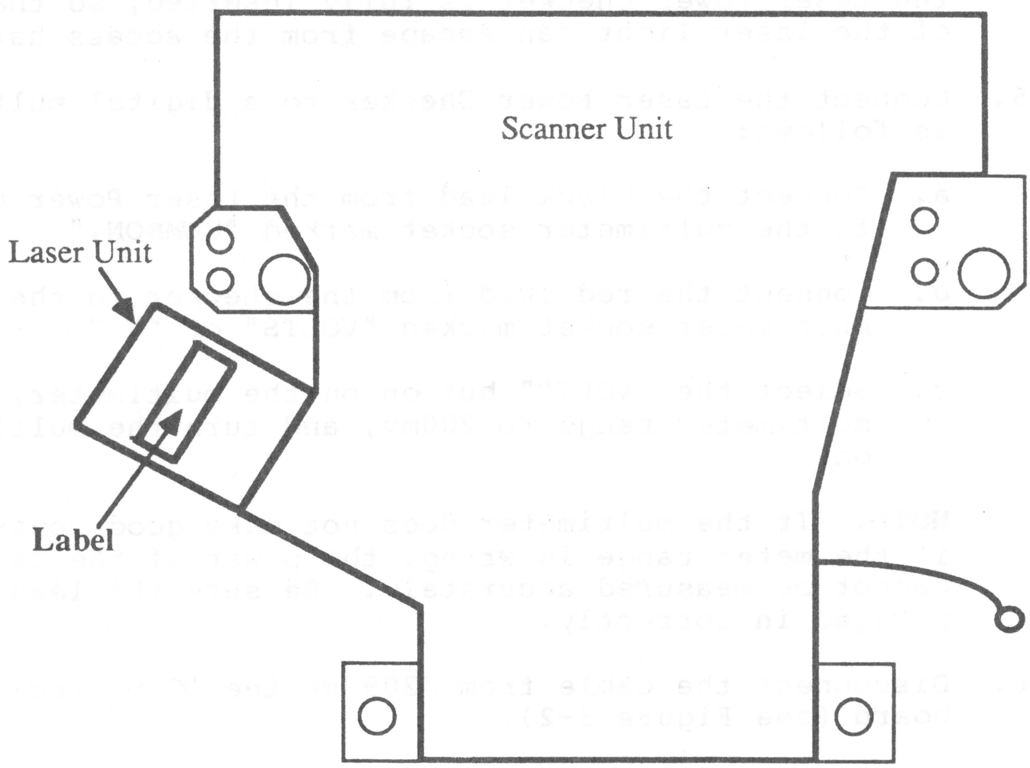


Figure 3-3

14. Before making any adjustment, make sure that the jumper between J209 pin 7 and pin 6 is removed. Then, if the laser output is too high, turn VR202 a little counterclockwise. If the laser output is too low, turn VR202 a little clockwise. Move the resistor in very small increments.

15. Install the jumper and measure the laser output as before (steps 10, 11, and 12).

16. If the laser output is now within the range indicated, no further adjustment is required. If it is not, repeat steps 14 and 15 until the adjustment is within the indicated range.

17. **Turn power off** and remove all jumper wires.

18. Remove the Laser Power Checker and **close the access hatch securely.**

19. Reconnect J209 to the DC Controller board.

20. Reinstall the LaserWriter I/O board and the top cover.

21. Turn the printer on and verify correct operation by waiting for the automatic test print to be generated.

3.B IMAGE SKEW ADJUSTMENT (P/N 011-7051)

If there is a large registration problem -- that is, if the image on the page looks very skewed -- the cause is probably the paper cassette or some other part of the paper feed path. But if it is a small skew -- just a millimeter or two -- you can fix it by adjusting the position of the laser/scanner unit. If the problem appears when using the types and weights of paper recommended for the LaserWriter, the adjustment is covered under warranty. If the problem only occurs with paper that is outside the recommended types or weights, be sure to warn the user that adjusting the printer for unusual weights of paper is not covered under warranty and that it may cause skewing problems when the recommended types of paper are used.

To Check Adjustment:

1. Make sure the type of paper recommended by the user's guide is loaded into the paper cassette (ordinary duplicator paper is acceptable). Then generate a user test print by turning the printer off and then on again.

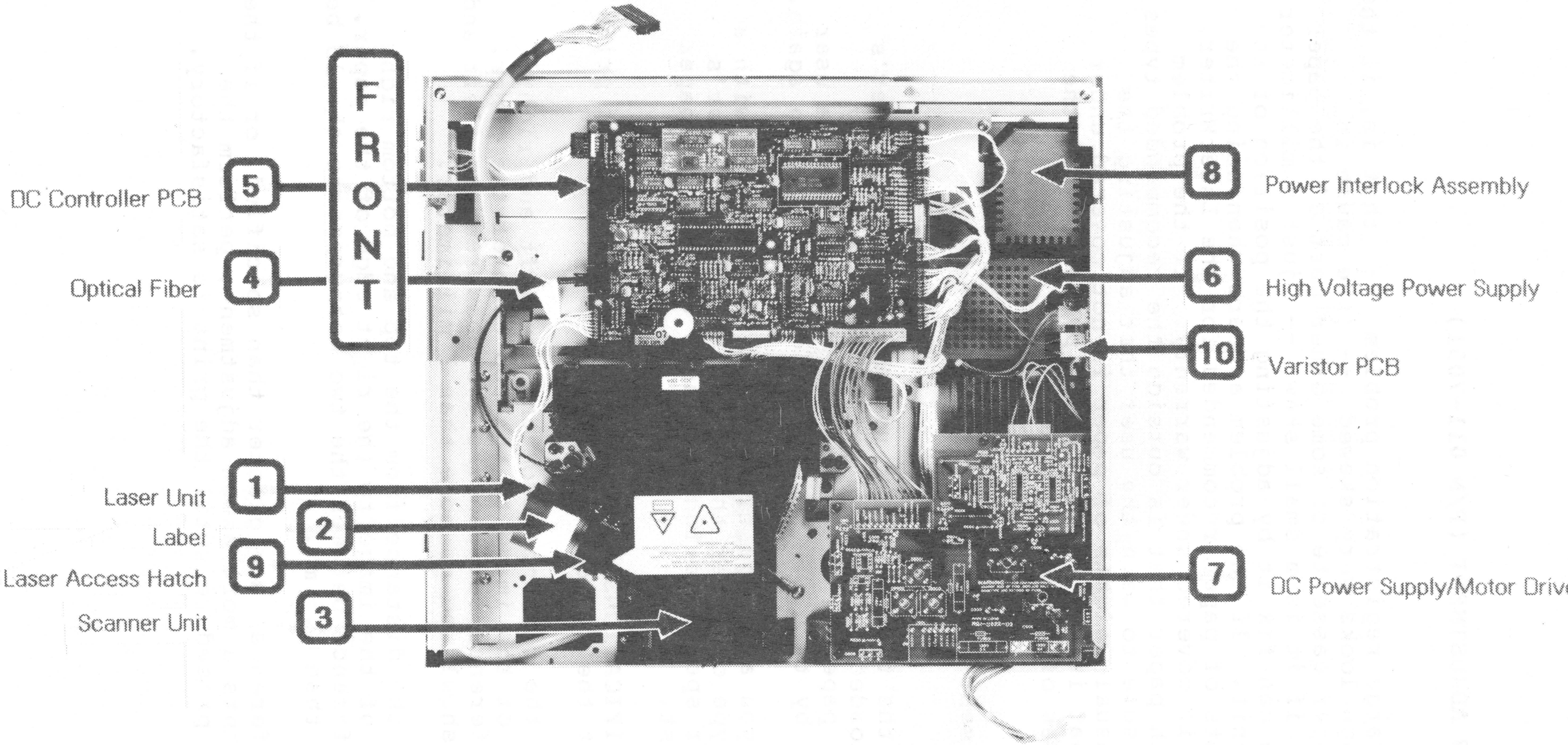
   NOTE: If you are adjusting the printer to work with a specific type of paper that is outside the printer's usual paper specifications, be sure to use that paper for the test.

2. **IMAGE SPECIFICATIONS:** The border around the test print should meet the following criteria:

   a) Measure the distance from the top left and right corners of the image to the top edge of the paper. The difference between the two measurements (left and right) should be no more than 1 millimeter.

   b) Measure the distance from the top and bottom right corners of the image to the right edge of the paper. The difference between the two measurements should be no more than 1.5 mm.

   If the differences are greater than specified, or if the customer wants a more exact adjustment, perform the adjustment procedure until the print is satisfactory.



TOP VIEW OF LASERWRITER WITH I/O BOARD REMOVED

Figure 3-4

To Adjust the Image:

1. Switch the printer OFF and remove the top cover.

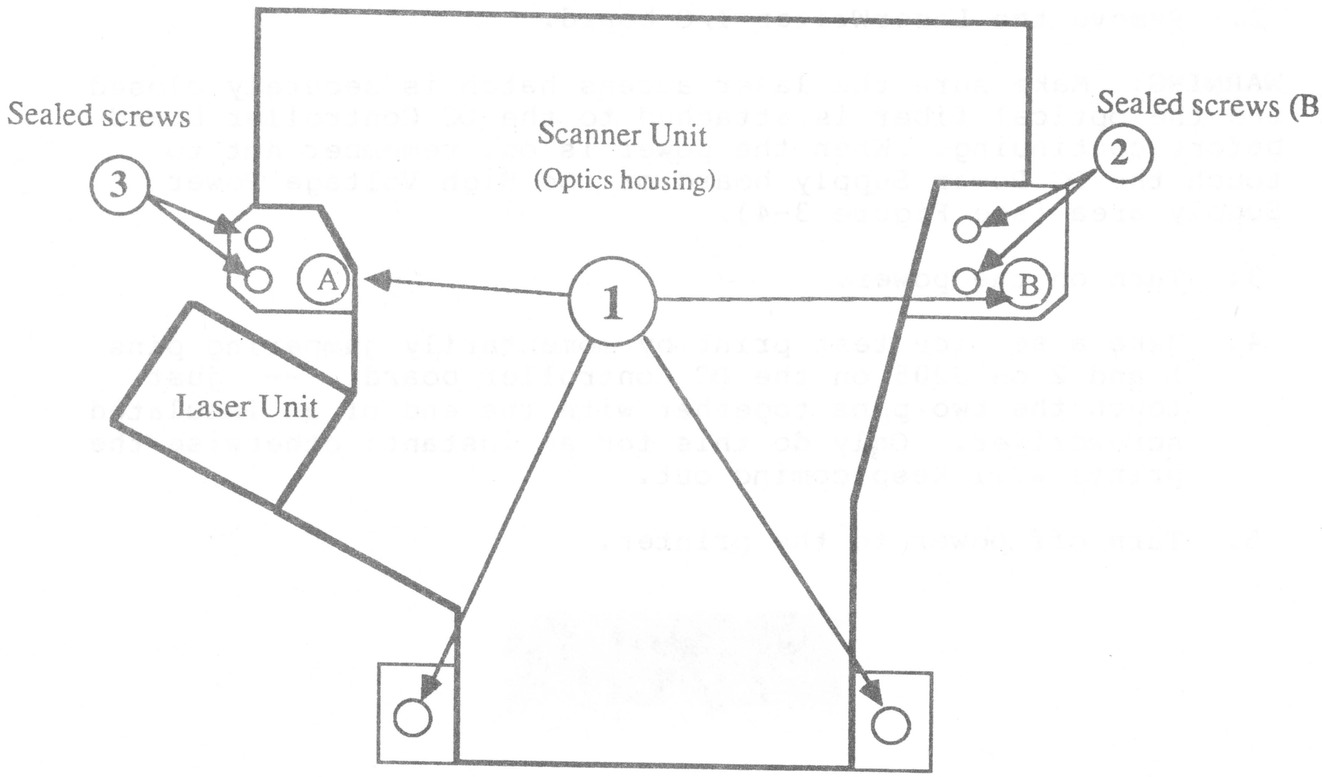
2. Remove the LaserWriter I/O board.

WARNING: Make sure the laser access hatch is securely closed and the optical fiber is attached to the DC Controller board before continuing. When the power is on, remember not to touch the DC Power Supply board or the High Voltage Power Supply area (see Figure 3-4).

3. Turn on the power.

4. Make a service test print by momentarily jumpering pins 1 and 2 on J205 on the DC Controller board -- just touch the two pins together with the end of an insulated screwdriver. Only do this for an instant: otherwise the prints will keep coming out.

5. Turn off power to the printer.



Sealed screws
Scanner Unit
(Optics housing)
Sealed screws (B)
3
2
A
1
B
Laser Unit

Figure 3-5

6. To make the scanner unit movable, loosen the four large mounting screws (Figure 3-5, #1) and the two sealed screws farthest from the laser (Figure 3-5, #2).

7. Move the scanner unit: rotating the unit clockwise makes the image rotate counterclockwise, and vice versa.

8. Make another service test print by turning on power and jumpering pins 1 and 2 on J205. Then measure the image skew as directed above.

   Repeat steps 7 - 8 until the adjustment is satisfactory or until you are unable to move the unit any further.

Stage Two

If you cannot achieve optimum adjustment using steps 1-8, continue with the following steps.

9. Turn off the printer power.

10. Tighten the two sealed screws you had loosened earlier on the far side of the scanner (Figure 3-5, #2) and loosen the two sealed screws near the laser unit (Figure 3-5, #3).

11. Rotate the scanner unit around the screw on the far side of the scanner unit: rotating the unit clockwise makes the image rotate counterclockwise, and vice versa.

12. Make another service test print by turning on power and jumpering pins 1 and 2 on J205. Then measure the image skew as directed above.

    Repeat steps 11 - 12 until the adjustment is satisfactory. If necessary, return to steps 6-8 for further adjustments.

Final check

When the adjustment is satisfactory, carefully tighten all screws. Turn off the power to the printer and put back the LaserWriter I/O board. To verify your adjustment, generate a user test print by turning on the power, and measure the image skew as directed above.

Apple LaserWriter Printer
Introductory Technical Procedures

Section 4 - Troubleshooting

Contents:

II- Electromechanical Problems (continued)

How to Use the Troubleshooting Section

Use this section as a guide to diagnosing and repairing LaserWriter Printer failures. To troubleshoot the LaserWriter printer, follow these steps:

1. Use the Quick Fix Guide (on the next page) to check for proper LaserWriter Printer installation and set up.
2. Attempt a test print (make sure cartridge and paper are installed, then turn the power on).
3. Note the symptoms and refer to the Troubleshooting Tables (the pages following the Quick Fix Chart).
4. Verify all repairs by making a test print.

Quick Fix Guide

Installation Checklist

* Line Voltage OK (115VAC plus or minus 10%)
* Printer installed on solid level surface
* Room temperature between 50 - 90 F (10 - 32.5 C)
* Humidity between 20% and 80%
* Printer not located near: water tap
  boiler
  humidifier
  open flame
  dusty location
* Printer not exposed to ammonia gas (produced by Diazo copiers or cleaning solutions)
* Printer not exposed to direct sunlight
* Printer is installed in a well-ventilated area

Initial Checks

* Cables and connectors ok
* Toner cartridge ok (replace if indicator is red)
* Print density adjustment dial set correctly
* Protocol selector switch (on back of printer) set correctly
* Paper is 16-21 lb. standard photocopier paper
* Fixing roller cleaner felt in place and not dirty
* Paper cassette properly loaded with paper (not more than 10mm high)
* Transfer corona wire ok (check for broken or dirty wire)
* Separation belt ok (check for nicks or broken belt)

Indicator Lamps

Ready lamp (green) - flashes for approximately 90 seconds on power up and thereafter stays lit if all of the following conditions are met:

- laser chip temperature correct
- upper fixing roller temperature correct
- toner cartridge installed
- cassette loaded with paper or paper is placed on manual feed tray if in manual feed mode
- there are no jams
- pickup sensor (PS1) does not detect paper
- printer is not in pause
- main motor is rotating properly

Paper lamp (yellow) - normally off - if lit steadily indicates an out of paper condition - will flash intermittently after a print command is given while the printer computes the print image

Jam lamp (red) - normally off - if lit indicates a paper jam has been detected

Test lamp (green) - normally off - if flashing, the Laserwriter I/O board should be replaced (the test lamp is located on the back of the printer, underneath the AppleTalk connector)

LED 201 - lights continuously when the laser beam is turned on at more than the specified intensity (located in the center of the DC controller board)

LED 401 - lights continuously when the scanner motor is rotating at the specified speed (located on the scanner/driver PCB - can be viewed from the right hand side of the printer when the top cover is removed)

LED 501 - lights continuously when the main motor is rotating at the specified speed (located on the component side, facing down, of the DC power supply and main motor driver PCB near connector J503)

How to Read the Troubleshooting Tables

The troubleshooting tables are explanations of the general servicing procedure. The example below shows how to read the tables.

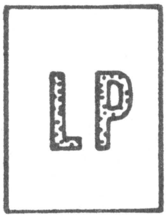
(Example) - THERE IS NO POWER

Step	Check	Result	Action
1	Is the printer plugged in?	NO	Plug in the printer
2	Is the printer firmly closed?	NO	Close the printer
3	Is the required voltage supplied at the AC outlet?	NO	Nothing is wrong with the printer. Take steps to provide an adequate power supply
4	Is circuit breaker CB1 open?	YES	Reset the circuit breaker. If the breaker trips as soon as reset there is a short that will have to be located
		NO	Make sure the power is off. Unplug the printer. Open the printer and disconnect J105 on the AC driver PCB. Make sure that circuit breaker CB1 is reset and has continuity. If the circuit breaker is defective replace it.

To solve a problem, begin at step one and perform the check explained there. If the result is not as indicated in the "Result" column, go to the next step number. But if the result is as indicated in the Result" column, perform the action indicated in the "Action" column and observe what happens. If the problem is not eliminated, continue to the next step.

IMAGE DEFECTS

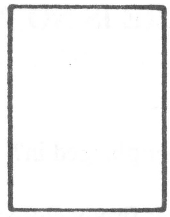
Examples of Image Defects



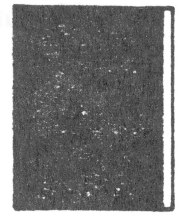
Light image



Dark image



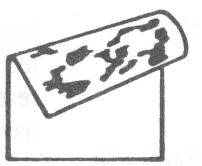
Blank print



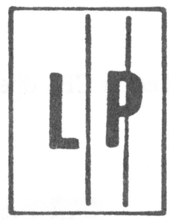
Black image



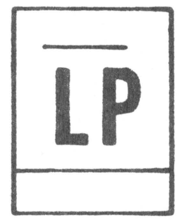
Stained separation strip



Stains on back of paper



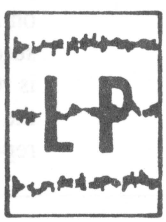
Dark vertical lines



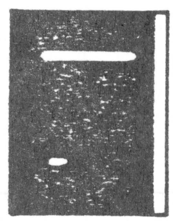
Sharp horizontal black lines



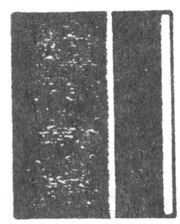
Vertical fogged stripes



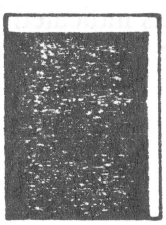
Horizontal fogged stripes



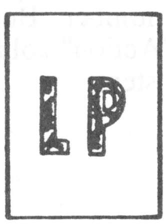
White horizontal lines/ other shapes on a black print



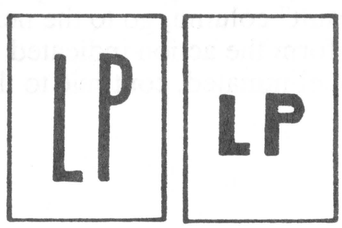
Thin vertical white lines/stripes



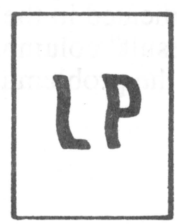
Faulty registration



Poor fixing



Distortion



Waviness

I- IMAGE DEFECTS

I.A- LIGHT IMAGE (WHOLE PRINT)

Step	Check	Result	Action
1	Is the print density adjustment dial set with its dot at the top?	NO	Set the dial so that its dot is at the top.
2	Is the toner cartridge indicator red?	YES	Replace the toner cartridge.
3	Do prints improve when new paper is used	YES	Replace the paper with approved paper (16-21 Lb. standard photocopier paper).
4	Is the transfer corona wire broken?	YES	Replace the transfer corona wire.
5	Is connector J211 on the DC Controller board securely connected?	YES	Replace the DC Controller board.
6	Is laser power output normal?	NO	Adjust laser power (refer to Laser Power Adjustment procedure in Adjustments section).

I.B- DARK IMAGE (WHOLE PRINT)

Step	Check	Result	Action
1	Is the print density adjustment dial set with its dot at the top?	NO	Set the dial so that its dot is at the top.
2	Is laser power output normal?	NO	Adjust laser power (refer to Laser Power Adjustment procedure in Adjustments section).

I.C- BLANK PRINT

Step	Check	Result	Action
1	Is the toner cartridge indicator red?	YES	Replace the toner cartridge.
2	Has the sealing tape been removed from the toner cartridge	NO	Remove it.
3	Do the toner cartridge protective shield and the light-blocking shutters open when a toner cartridge is inserted? Does the laser beam-blocking shutter (in the printer, above the cartridge) open?	NO	Locate the cause of the trouble and repair. If the cause is in the toner cartridge, replace the cartridge.
4	Is connector J211 on the DC Controller board securely connected?	YES	Replace the DC Controller board.
5	Is laser power output normal?	NO	Adjust laser power (refer to Laser Power Adjustment procedure in Adjustments section).
6	Does the green test light on the rear (I/O) connector blink continuously when printer power is turned on?	YES	Replace LaserWriter I/O board.

I.D- BLACK IMAGE

Step	Check	Result	Action
1	Is the primary corona wire inside the toner cartridge broken?	YES	Replace the toner cartridge.
2	Is connector J211 on the DC Controller board securely connected?	YES	Replace the DC Controller board.
3	Does the green test light on the rear (I/O) connector blink continuously when printer power is turned on?	YES	Replace LaserWriter I/O board.

I.E- SCRAMBLED IMAGE ("GARBAGE")

Step	Check	Result	Action
1	Turn printer off and then on again. Does green test light on rear (I/O) connector plate blink continuously, and/or is self-test printout scrambled?	YES	Replace LaserWriter I/O board.

I.F- STAINED SEPARATION STRIP

Step	Check	Result	Action
1	Are the separation belt, separation roller, or pinch roller (near the separation belt) dirty?	YES	Clean them.
		NO	Replace the toner cartridge.

I.G- STAINS ON BACK OF PAPER

Step	Check	Result	Action
1	Is the fuser roller cleaner felt dirty?	YES	Replace the fuser roller cleaner felt.
2	Is there any toner on the underside of the toner cartridge?	YES	Clean with a damp cloth, then with a dry cloth.
3	Is there toner on the transfer guides or are the guides dirty?	YES	Clean with a damp cloth, then with a dry cloth.
4	Is there any toner on the Transfer Corona Assembly feeder guides?	YES	Clean with a damp cloth, then with a dry cloth.
5	Is there any toner on the separation belt, separation roller, or pinch roller?	YES	Clean with a damp cloth, then with a dry cloth.
6	Is the manual paper feed guide dirty or not grounded?	YES	Clean with a damp cloth, then with a dry cloth. Ground it if it is not correctly grounded.
7	Does the leading-edge blank area on printed pages measure about 5mm?	NO	Replace the DC Controller PCB.
8	Are the transfer guides correctly grounded via 15MΩ resistance when the printer upper unit is closed?	NO	Ground them correctly.
9	Is the fuser assembly correctly grounded?	NO	Ground it correctly

I.H- DARK VERTICAL LINES (PAPER FEED DIRECTION)

Step	Check	Result	Action
1	Is the fuser roller cleaner felt dirty?	YES	Replace the fuser roller cleaner felt
2	Turn the printer off in the middle of printing and open the upper half of the printer. Open the protective shield on the toner cartridge. Can you see a vertical line on the drum? (Make this check as quickly as possible and in dim light, to prevent light from damaging the drum.)	YES	Replace the toner cartridge

I.I- SHARP HORIZONTAL BLACK LINES (CROSS FEED DIRECTION)

Step	Check	Result	Action
1	Is the laser power set properly?	NO	Adjust laser power (refer to laser adjustment procedure)
2	Execute a test print while the printer is in the ready state by jumpering pins 1 and 2 on J205 on the DC Controller board. Does the scanner motor start and LED401 on the scanner driver PCB light continuosly?	YES	Proceed to step 5.
3	Are J401 on the scanner driver PCB and J206 on the DC Controller board securely connected?	NO	Connect J401 or J206.
4	Does the voltage between J206-4 and J206-2(GND) vary from about +7VDC to about OVDC when step 2 is performed?	NO	Replace the DC Controller PCB.
		YES	Replace the scanner unit. If this does not correct the problem, go to the next step.
5	Perform step 2, then wait 3 minutes and check the voltage between J401-3 and J401-2(GND) on the scanner driver PCB. Does the voltage vary from about +3VDC to about OVDC?	YES	Replace the DC Controller PCB. If the problem is not solved, put the old PCB back in the printer and replace the scanner unit.
		NO	Replace the scanner unit.

I.J- VERTICAL FOGGED STRIPES (PAPER FEED DIRECTION)

Step	Check	Result	Action
1	Clean the primary corona wire in the toner cartridge. Does the print image improve after cleaning the primary corona wire?	NO	Replace the toner cartridge.

I.K- HORIZONTAL FOGGED STRIPES (CROSS FEED DIRECTION)

Step	Check	Result	Action
1	Check the distance of the stripes from the edge. Are they about 188mm or 66mm from the edge of the prints? (The circumference of the drum is 188.5mm, that of the developing cylinder, 66mm.)	YES	Replace the toner cartridge.

I.L- WHITE HORIZONTAL LINES OR OTHER SHAPES ON A BLACK PRINT

Step	Check	Result	Action
1	Is approved paper being used?	NO	Replace with approved paper (16-21 Lb. standard photocopier paper). Explain to user that use of non-approved paper may cause poor quality prints.
2	Is paper damp?	YES	Replace the paper. Instruct user to store paper in its package in a dry place and not to open packages before ready to use paper.

I.M- THIN VERTICAL LINES OR STRIPES (PAPER FEED DIRECTION)

Step	Check	Result	Action
1	White stripes are being produced?	YES	If toner cartridge indicator is green, rock the cartridge to spread the toner evenly. If the indicator is red, replace the toner cartridge.
2	Is the fuser roller cleaner felt dirty?	YES	Replace the fuser roller cleaner felt.
3	Do prints improve after the transfer corona wire is cleaned?	YES NO	Finished Replace the toner cartridge. If that does not work put back the original cartridge and go to next step
4	Remove the toner cartridge and manually open the laser beam blocking shutter in the printer (above the cartridge). Check the area for obstacles or blockages. Are there any?	YES	Remove the obstacles or clean the area with a fine brush.
5	Remove the laser/scanner unit. Check to see if the dustproofing glass on the bottom of the laser/scanner unit is dirty.	YES	Clean the dustproofing glass with lint-free cloth. Dust should not be left on the glass.

I.N- FAULTY REGISTRATION

Step	Check	Result	Action
1	Is the paper cassette loaded with too much paper (more than 10mm high)?	YES	Remove the excess paper
2	Has either guide spring (located at ends of the feed roller shaft on the registration shutter ass'y) come loose?	YES	Reinstall the guide springs.
3	Is the leading edge of the paper showing excessive curl?	YES	Straighten paper edges or replace paper.
4	Is approved paper being used?	NO	Replace with approved paper (16-21 Lb. standard photocopier paper).
5	Are the feed rollers dirty? (cassette pickup assembly)	YES	Clean with a damp cloth, then with a dry cloth.
6	Is the problem still there?	YES	Replace the DC controller board

I.O- POOR FIXING (IMAGE SMEARS EASILY)

Step	Check	Result	Action
1	Is approved paper being used?	NO	Replace paper with approved paper (16-21 Lb. standard photocopier paper).
2	Are the upper and lower fuser rollers worn?	YES	Replace fuser assembly.
		NO	Replace the fuser heater bulb.

I.P- WAVINESS

Step	Check	Result	Action
1	Does LED 401 on the scanner driver PCB light continuosly?	NO	Replace the DC Controller PCB. If the problem is not solved, reinstall the DC Controller PCB and replace the scanner unit.

II- ELECTROMECHANICAL PROBLEMS

II.A- THERE IS NO POWER

(If air is blowing through the louver when the power is switched on, start at step 5)

Step	Check	Result	Action
1	Is the printer plugged in?	NO	Plug in the printer.
2	If the printer firmly closed?	NO	Close the printer.
3	Is the required voltage supplied at the AC outlet?	NO	Nothing is wrong with the printer. Take steps to provide an adequate supply of power.
4	Is circuit breaker CB1 open?	YES	Reset the circuit breaker. If the breaker trips as soon as reset, there is a short that will have to be located.
		NO	Make sure the power is off. Unplug the printer. Open the printer and remove the AC Driver PCB assembly (two PCBs inside the Power Interlock Ass'y), to access the circuit breaker. Make sure that circuit breaker CB1 is reset and has continuity. If the circuit breaker is defective, replace it.
5	Shut the printer and remove the top cover. Are the DC voltages listed below supplied between the J502 pins on the DC Power Supply/ Motor Drive PCB? 1) J502-4 and J502-8(GND) 24-35VDC 2) J502-9 and J502-8(GND) 24VDC 3) J502-7 and J502-6(GND) 5VDC 4) J502-5 and J502-6(GND) -5VDC 5) J502-2 and J502-3(GND) 20-30VDC	YES	Go to step 13.
6	Turn the printer off. Make sure that J502 is connected to the DC Power Supply/Motor Drive PCB. Disconnect all connectors on the DC Controller PCB except J208. Are any of the J502 pins listed below shorted? (Measure resistance on connector pins on the Power Supply/Motor Drive board with the cable attached to the board.) 1) J502-4 and J502-8 2) J502-9 and J502-8 3) J502-7 and J502-6 4) J502-5 and J502-6 5) J502-2 and J502-3	YES	Check the wiring between J502 and J208 for a short. If there is no short, replace the DC Controller PCB.

Step	Check	Result	Action
7	Reconnect all the connectors on the DC Controller PCB. Are any of the following J502 pins on the DC Power Supply/Motor Drive PCB shorted now? 1) J502-4 and J502-8 2) J502-9 and J502-8 3) J502-7 and J502-6 4) J502-5 and J502-6 5) J502-2 and J502-3	NO	Go to step 13.
8	Were J502-9 and J502-8 shorted?	NO	Go to step 10.
9	Disconnect connectors J215, J212; J210; J216; J213; J211; J208 and J206. Reconnect them in the sequence shown below. After each connector is replaced check for shorts between the pins shown below. Are any shorts found? J215-3 and J215-1; J215-5 and J215-1 J210-1 and J210-5; J210-3 and J210-5 J210-7 and J210-5 J216-3 and J216-1 J213-8 and J213-1 J211-6 and J211-1 J206-1 and J206-2	YES	Replace the module attached to the shorted connector.
10	Are J502-7 and J502-6 shorted?	NO	Go to the next step.
11	Are J502-2 and J502-3 shorted?	NO	Go to step 13
12	Disconnect J204 on the DC Controller PCB. Are J201-1 and J208-8 or pins1 and 4 of the connector on the J204 cable shorted?	YES	Check the wiring between J204 and TB3 and TB4 (on the laser unit's PCB) for a short. If there are no shorts, replace the laser unit.
13	Plug in all the connectors on the DC Power Supply/Motor Drive PCB and DC Controller PCB. Check that the circuit breaker has been reset and the printer is closed. Switch the printer on. Are the DC voltages shown in the table below supplied between the pins on the DC Controller PCB? 1) J208-4 and J208-8(GND) 24-35VDC 2) J208-9 and J208-8(GND) 24VDC 3) J208-7 and J208-6(GND) 5VDC 4) J208-5 and J208-6(GND) -5VDC 5) J208-2 and J208-8(GND) 20-30VDC	NO	Check wiring between J502 and DC Power Supply/Motor Drive PCB and J208 on the DC Controller PCB for good contact or wiring damage.
		YES	Replace the DC Controller PCB.

II.B- THE FUSER ROLLER HEATER DOES NOT OPERATE

Step	Check	Result	Action
1	Are the thermistor and thermoprotector (the two sensors above the upper roller in the Fuser Assembly) dirty?	YES	Clean them.
		NO	Replace the DC Controller PCB.

II.C- JAMS ARE DETECTED WHEN THERE ARE NO JAMS

Step	Check	Result	Action
1	Does the JAM indicator on the display unit light up when the printer is switched on?	YES	Check the wiring between J201 on the DC Controller PCB and TB18 on the display unit. If it is OK, replace the DC Controller PCB.
2	Is a paper fragment or some other obstacle caught in the delivery unit?	YES	Remove the obstruction.
3	Does the voltage between J210-6 and J210-5(GND) on the DC Controller PCB go from about 0VDC to +5VDC when paper is set on the manual feed tray?	NO	Check J4 of the pickup sensor PS1 and J210 on the DC Controller PCB for poor contact. Also check that the paper detection arm functions smoothly
4	Open the upper half of the printer and activate the door switch with a screwdriver. Shield the light from delivery sensor PS3 (under the fan) with paper. Does the voltage betwee J216-2 and J216-2(GND) on the DC Controller PCB vary from about 0VDC to +5VDC?	NO	Check J5 of the pickup sensor PS3 and J216 on the DC Controller PCB for poor contact. Also check that the paper delivery sensor arm (on top of the Fuser Assembly) functions smoothly.

II.D- JAMS ARE NOT DETECTED

Step	Check	Result	Action
1	Does the JAM indicator on the display unit light up when the circuit between J201-4 and J208-6(GND) on the DC Controller PCB is shorted?	NO	Check J201 on the DC Controller PCB and TB18 on the display unit for good contact. If the contact is good check whether +5VDC is supplied between J201-4 and J208-6(GND) on the DC Controller PCB. If +5VDC is there replace the display unit. If it is not there, go to "THERE IS NO POWER."
2	Does the voltage between J210-6 and J210-5(GND) on the DC Controller PCB go from about 0VDC to +5VDC when paper is set on the manual feed tray?	NO	Check J4 of the pickup sensor PS1 and J210 on the DC Controller PCB for poor contact. Also check that the paper detection arm on the Registration Shutter Assembly functions smoothly.
3	Open the upper half of the printer and activate the door switch with a screwdriver. Shield the light from delivery sensor PS3 (below fan) with paper. Does the voltage between J216-2 and J216-1(GND) on the DC Controller PCB vary from about 0VDC to +5VDC?	NO	Check J6 of delivery sensor PS3 and J216 on the DC Controller PCB for poor contact. Also check that the paper delivery sensor arm (on top of the Fuser Assembly) functions smoothly.
4	Is a pulse applied between J208-12 and J208-3(GND) on the DC Controller PCB when printing occurs? Check with a scope or logic probe.	NO	Check the wiring between J502 on DC Power Supply/Main Motor Driver PCB and J208.

II.E- THE PAPER OUT INDICATOR LIGHTS WHEN THERE IS STILL PAPER

Step	Check	Result	Action
1	Does the voltage between J215-2 and J215-1(GND) on the DC Controller vary from about +5VDC to 0VDC when the paper detection arm in the pedestal lifts?	NO	Check J5 on the paper-out sensor in the pedestal, J215 on the DC Controller and the wiring in between for good contact. Also check that the paper detection arm in the pedestal moves smoothly.
2	Does the PAPER OUT indicator go out when a cassette with paper is installed?	NO	Replace the DC Controller PCB

II.F- THE PAPER OUT INDICATOR DOES NOT LIGHT WHEN THERE IS NO PAPER

Step	Check	Result	Action
1	Does the PAPER OUT indicator on the display unit light up when the circuit between J201-3 and J208-6 (GND) on the DC Controller PCB is shorted?	NO	Check J201 on the DC Controller PCB and TB18 on the display unit for good contact. If the contact is good, check whether +5VDC is supplied between J201-1 and J208-6 (GND) on the DC Controller PCB. If +5VDC is there, replace the display unit. If it is not there, go to "THERE IS NO POWER."
2	Does the voltage between J215-2 and J215-1(GND) on the DC Controller vary from about +5VDC to 0VDC when the paper detection arm in the pedestal lifts?	NO	Check J5 on the paper sensor, J215 on the DC Controller and the wiring in between for good contact. Also check that the paper detection arm moves smoothly.
3	Does the PAPER OUT indicator light when a cassette with paper is removed?	NO	Replace the DC Controller PCB.

II.G- LASER OR SCANNER MALFUNCTION

Step	Check	Result	Action
1	Is the laser power set properly?	NO	Adjust laser power to the proper level. If this can't be done, go to "LASER OR FUSER HEATER MALFUNCTION," Step 3.
2	Make a test print while the printer is in the ready state by jumpering pins 1 and 2 on J205 (on the DC Controller). Does the scanner motor start and does LED401 on the scanner driver PCB light continuously?	YES	Proceed to step 6
3	Check that J401 on the scanner driver PCB and J206 on the DC Controller board are securely connected	NO	Connect J401 or J206
4	Is +24VDC supplied between J401-1 and J401-2 (GND) on the scanner driver PCB?	NO	Check J502 on the DC Power Supply and J208 on the DC Controller board for secure contact.
5	Does the voltage between J206-4 and J206-2 (GND) vary from about +7VDC to about OVDC when the same procedure as in step 2 is performed?	NO	Replace the DC Controller PCB
		YES	Replace the scanner unit. If this does not correct the problem go to step 6
6	Perform step 2; then wait 3 minutes. Does the voltage between J401-3 and J401-2 (GND) on the scanner driver PCB vary from about +3VDC to about OVDC?	YES	Replace the DC Controller PCB. If the problem is not solved, put the old PCB back in the printer and replace the scanner unit.
		NO	Replace the scanner unit

II.H- LASER OR FUSER HEATER MALFUNCTION

Step	Check	Result	Action
1	Switch the printer on and wait one minute. Open the printer and lift the cover of the fuser assembly. Has the temperature of the upper roller increased?	NO	Go to "THE FUSER ROLLER HEATER DOES NOT OPERATE"
2	Close the printer. Is the voltage between J204-1 and J204-4 (GND) in the range of +20-30VDC and is the voltage between J204-5 and J204-4 (GND) equal to +5VDC? (Measure the voltage between the pins on the cable connector, with the connector attached to the DC Controller board.)	NO	Check that the voltage between J208-2 and J208-3(GND) is +20-30VDC and the voltage between J208-7 and J208-6(GND) is +5VDC. If not, check the wiring between J502 on the DC Power Supply/ Main Motor Driver PCB and J208 for poor contact.
3	Switch the printer off. Disconnect J204 on the DC Controller PCB. Measure the resistance between pins 1 and 2 of the connector on the cable. Is it 40-55 ohms?	NO	Replace the laser unit and perform the Laser Power Adjustment (see Adjustments section).
4	Measure the resistance between pins 3 and 4 of the connector on the cable. Is it 5-15 k-ohms when the laser is at room temperature?	YES	Replace the DC Controller PCB
		NO	Replace the laser unit and perform the Laser Power Adjustment (see Adjustments section).

II.I- ALL LEDs ON THE DISPLAY PANEL DO NOT LIGHT

Step	Check	Result	Action
1	Is a toner cartridge installed in the printer?	NO	Install a toner cartridge
2	Turn the printer off and then on again. Is the problem solved?	YES	Finished. Occasionally a momentary flicker will cause a beam detect signal malfunction. Turning the power off and then on again re-initializes the circuit and solves the problem. If this problem occurs frequently go to "LASER OR SCANNER MALFUNTION"
3	Is a pulse applied between J208-12 and J208-3(GND) on the DC Controller PCB when printing occurs? Check with a scope or logic probe.	NO	Go to "THE MAIN MOTOR DOES NOT ROTATE."
4	Is +5VDC supplied between J201-1 and J208-6(GND) on the DC Controller PCB	NO	Go to "THERE IS NO POWER."

II.J- THE READY/WAIT INDICATOR DOES NOT STOP FLASHING

Step	Check	Result	Action
1	Does the rear (I/O) connector plate's test light come on?	YES	Replace the LaserWriter I/O board.
		NO	Replace the DC Controller PCB.

II.K- THE READY/WAIT INDICATOR DOES NOT LIGHT

Step	Check	Result	Action
1	Do any of the other LEDs light steadily?	YES	If the PAPER OUT indicator is lit, put paper in the cassette. If the JAM indicator is lit, find and remove the paper jam.
2	Have all the LEDs on the display gone out?	YES	Go to "ALL LEDs ON THE DISPLAY PANEL DO NOT LIGHT". Is the problem solved? If not, go on to the next step.
3	Does the READY/WAIT indicator light steadily when the circuit between J201-2 and J208-6(GND) on the DC Controller PCB is shorted?	YES	Replace the DC Controller PCB.
		NO	Check J201 on the DC Controller PCB and TB18 on the display PCB for good contact. If contact is good check whether +5VDC is supplied between TB18 and J208-6(GND) on the DC Controller PCB. If so replace the display PCB. If not go to "THERE IS NO POWER."
4	Does the rear (I/O) connector plate's test light come on?	YES	Replace the LaserWriter I/O board.

II.L- PRINTING DOES NOT START WHEN A FILE IS SENT TO THE PRINTER

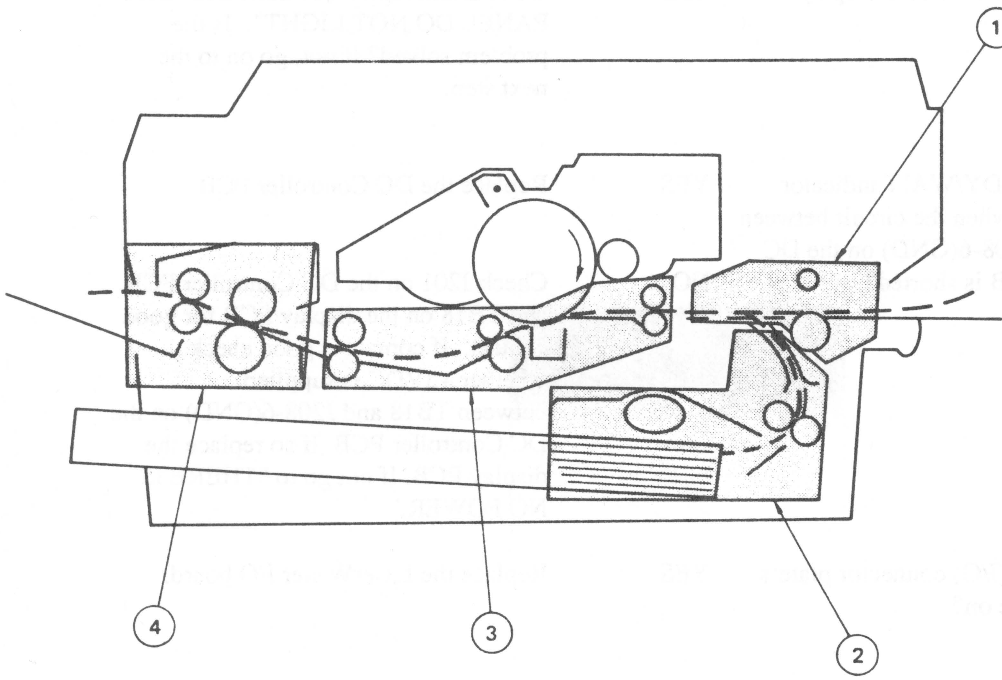
Step	Check	Result	Action
1	Is protocol selector switch on back of printer set correctly?	NO	Set switch to correct position.
2	Is appropriate network software and printer software installed on the application disk?	NO	Install the correct software.
3	Is the Macintosh defective? (Run MacTest.)	YES	Repair the defective Macintosh.
4	Is there a network problem? (Run test disk supplied with laser printer.)	YES	Refer to Macintosh Office troubleshooting.

II.M- READY/WAIT INDICATOR COMES ON BUT NO TEST PRINT IS PRODUCED

Step	Check	Result	Action
1	Is green "TEST" LED on rear (I/O) connector plate blinking?	YES	Replace LaserWriter I/O board.
2	Are major subassemblies not receiving power or is circuit breaker CB1 blown?	YES	Go to "THERE IS NO POWER"

III- PAPER JAMS

Paper in the printer passes through four main areas: (1) manual feed area; (2) cassette feed area; (3) separation/feed area; and (4) fuser/delivery area. Frequent jams in any area indicate that the area should be checked and repaired or cleaned and lubricated.



III.A- MANUAL FEED UNIT

Step	Check	Result	Action
1	Is approved print paper being used?	NO	Use approved paper (16-21 Lb. standard photocopier paper)
2	Is the paper wrinkled or curled?	YES	Replace the paper and make sure that the paper is stored correctly. Instruct the user.
3	Does the paper detection arm on the Registration Shutter Assembly move smoothly?	NO	Adjust the arm motion until it is smooth.
4	Is the lower feed roller dirty?	YES	Clean with alcohol.

III.B- CASSETTE PICKUP ASSEMBLY

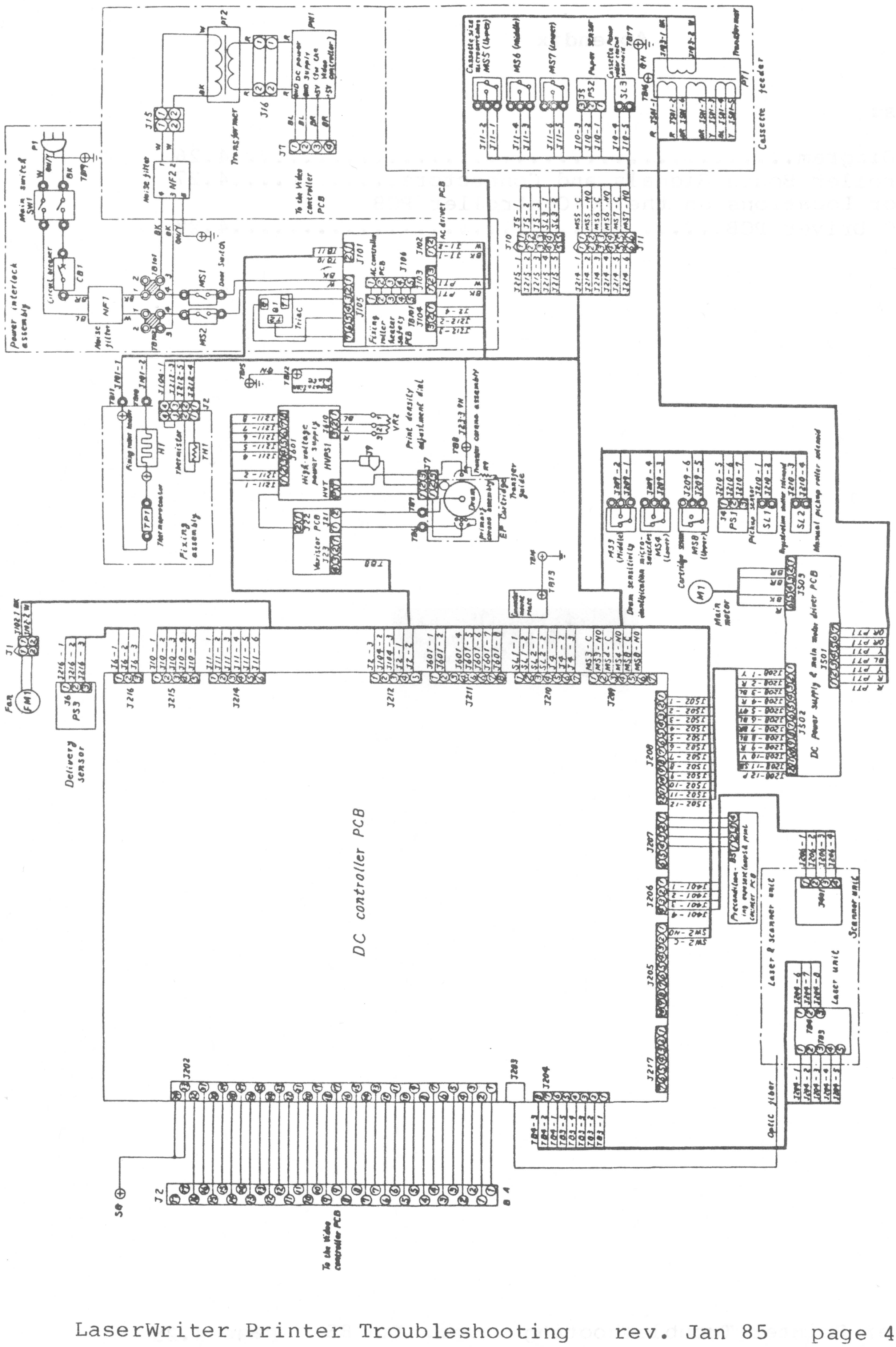
Step	Check	Result	Action
1	Is the internal cassette loaded with more than 10mm of paper?	YES	Remove the excess paper
2	Is approved print paper being used?	NO	Use approved paper (16-21 Lb. standard photocopier paper).
3	Is the paper wrinkled or curled?	YES	Replace the paper and make sure that the paper is stored correctly.
4	Is the cassette installed properly in the printer?	NO	Install the cassette properly.
5	Are any of the feed rollers on the assembly dirty?	YES	Clean with a damp cloth, then with a dry cloth.
6	Are any of the pickup rollers on the assembly dirty?	YES	Clean rollers with alcohol.

III.C- SEPARATION/FEEDER UNIT

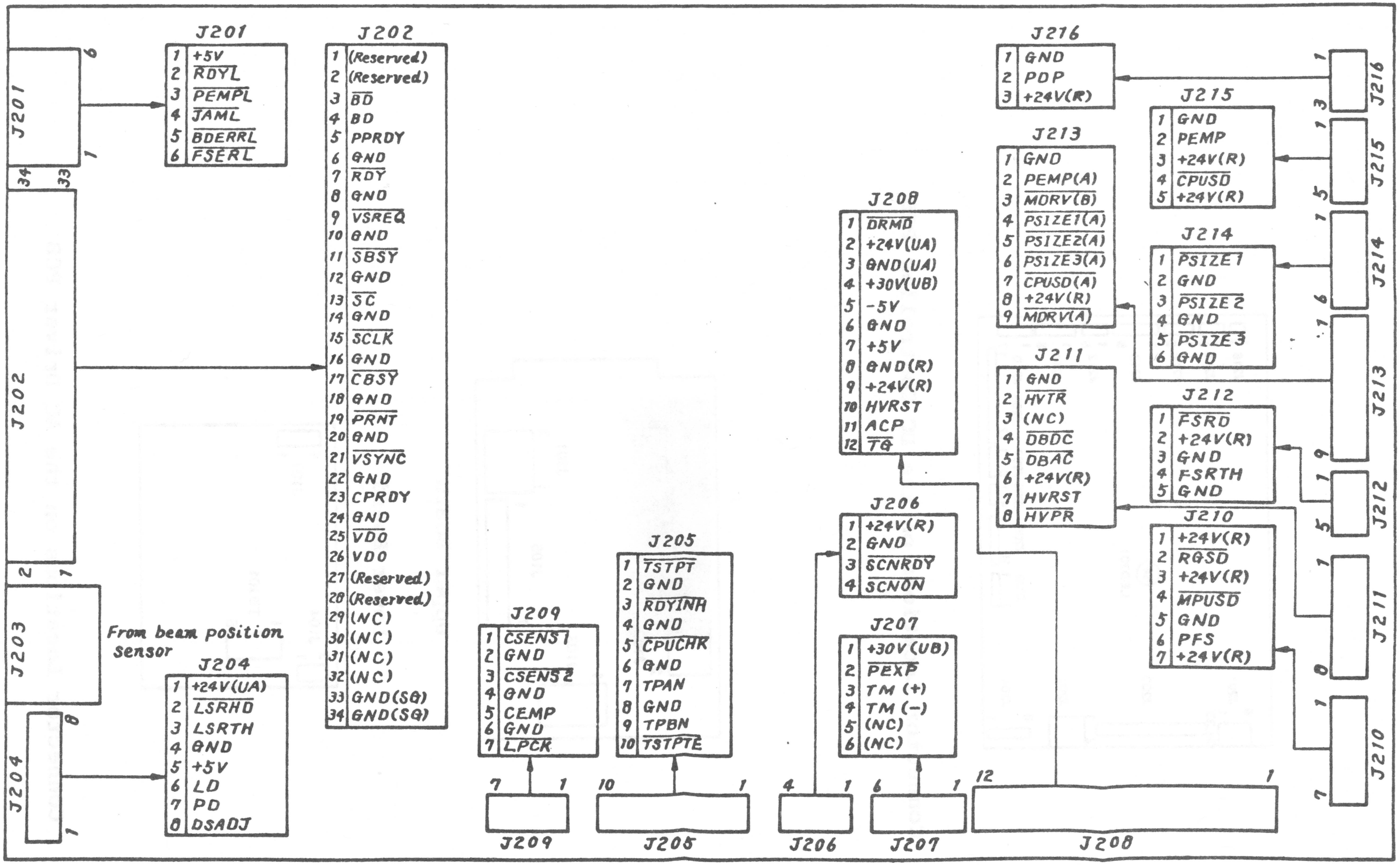
Step	Check	Result	Action
1	Is the separation belt damaged or twisted?	YES	Replace the separation belt.
2	Is the separation belt inside out?	YES	Reinstall correctly. The notched side of the belt should be facing away from the I/O connector plate.
3	Is any roller dirty or worn?	YES	Clean dirty rollers as necessary. Replace separation/feeder unit if rollers are badly worn.
4	Are the feeder rollers behind the Transfer Corona Assembly dirty?	YES	Clean with alcohol if dirty.
5	Is the guide wire on the Transfer Corona Assembly broken?	YES	Restring the guide wire.

Appendix

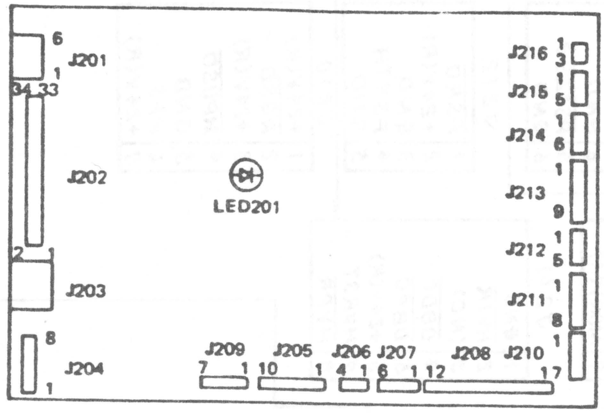
Contents:



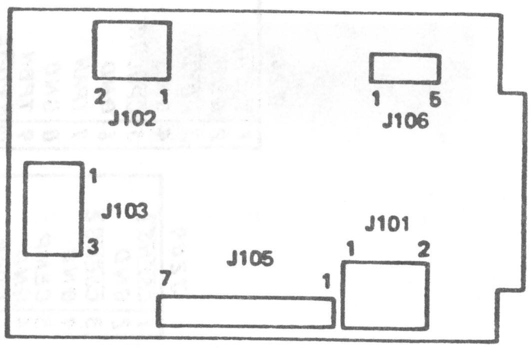
Wiring Diagram



DC Controller Board Signals and Connectors

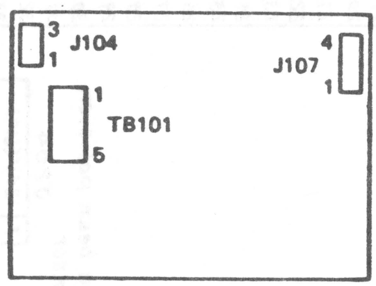


Connector Locations on the DC Controller PCB



Upper Board

Lower Board



Connector Locations on the AC Driver PCB

MACINTOSH OFFICE (APPLETALK)
TECHNICAL PROCEDURES

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Section 1: Macintosh Office Troubleshooting

Appendix A: AppleTalk Hardware Description

MACINTOSH OFFICE APPLETALK
TECHNICAL PROCEDURES

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Section 1: [illegible]

Appendix A: AppleTalk [illegible]

MACINTOSH OFFICE (APPLETALK)
TECHNICAL PROCEDURES

SECTION 1

Macintosh Office Troubleshooting

Contents:

MACINTOSH OFFICE TROUBLESHOOTING GUIDE

To Troubleshoot Your Macintosh™ Office:

(A) Collect the Following Items:

AppleTalk Installation Guide
LaserWriter (Owner's) Manual
2 Known Good LaserWriter Test Disks
AppleTalk™ Personal Network Components

(B) Familiarize Yourself With AppleTalk Components.

Refer to the Appendix to make sure you can identify the AppleTalk Personal Network components.

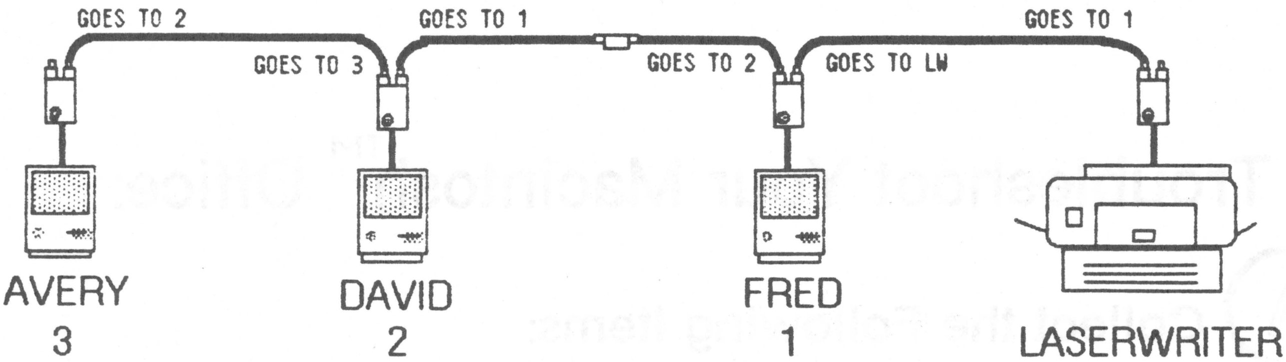
(C) Draw a Node Location Diagram.

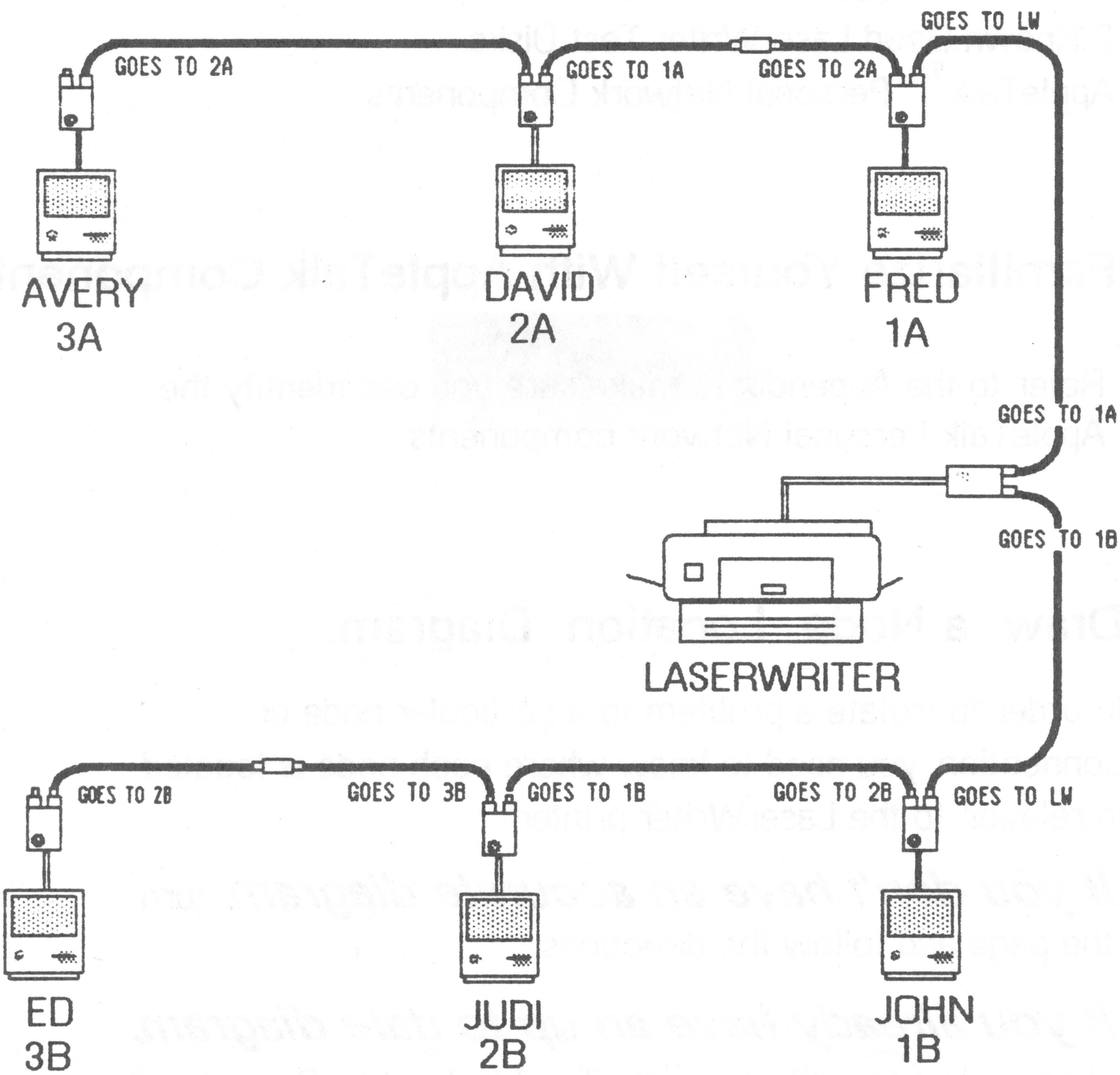
In order to isolate a problem to a particular node or connection, you need to know where each node is located in relation to the LaserWriter printer.

If you don't have an accurate diagram, turn the page and follow the directions.

If you already have an up to date diagram, then go to (D) "Perform the Troubleshooting Procedure".

NODE LOCATION DIAGRAM





Ⓒ Draw a Node Location Diagram. (continued)

A *node* is an AppleTalk connector and the device attached to it (Macintosh, Macintosh XL, LaserWriter, etc.).

A *Node Location Diagram* is a drawing of a Macintosh Office installation showing the location of all the devices on the network (Macintoshes, file servers, LaserWriters, etc.).

1. Number each node according to its sequence away from the LaserWriter (see the illustration on the opposite page).

   If the LaserWriter is somewhere in the middle of the network, number one side 1A, 2A, 3A etc. and the other side 1B, 2B, etc.

   Distances are not important for the diagram.
   The main reason for the diagram is to show which node is the first one connected to the LaserWriter, which is second, etc., and where the cable extenders are located.

2. Label all of the connector boxes in the network with their respective node numbers.

3. Label the plugs on both ends of every network cable with the node to which the cable leads (see the illustration on the opposite page).

Go to Ⓓ "Perform the Troubleshooting Procedure".

(D) Perform the Troubleshooting Procedure.

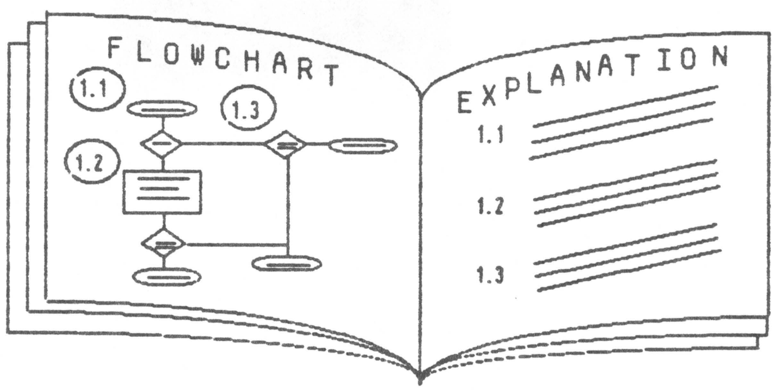
IMPORTANT: 1. You need to know that:

A *node* is an AppleTalk connector and the device attached to it (Macintosh, LaserWriter, etc.).

A *network bus* is the entire connected length of network cables and connection boxes.

2. Troubleshooting may interfere with the customers use of the network — so, if possible, perform this procedure when there is little or no activity (for example, at lunch time or after work).

3. Each troubleshooting procedure is made up of flowcharts. If you have a question about one of the steps in a flowchart, you can find an explanation of that step on the opposite page.



Find the Proper Flowchart.

Macintosh Office problems become apparent when attempting to print to the LaserWriter. These printing problems may present themselves in a variety of ways. They may be seen on a node computer as a system error message, system hang, constantly running disk drive, etc.

On the following page, determine which symptom best describes the problem. Then perform the suggested procedure.

SYMPTOM: Problems Printing to a LaserWriter Due To Installation Error.

Mistakes made during installation include:

* Connecting the AppleTalk Network cable so that it forms a closed loop (circular network).
* Not terminating the network cable into a connection box (dangling cable).
* Starting up an AppleTalk device before connecting it to the network.

If you have problems with a recently installed network, refer to the Troubleshooting section in the *AppleTalk Installation Guide*.

SYMPTOM: Only One Node Has Problems Printing to the LaserWriter.

This problem is usually caused by a loose connection but could be a malfunctioning computer. Go to the ONE NODE flowchart.

SYMPTOM: Two or More, But Not All Nodes Have Problems Printing to the LaserWriter.

This problem is usually a result of:

* Starting up AppleTalk on a device before connecting it to the Network OR
* A disconnected or broken network cable.

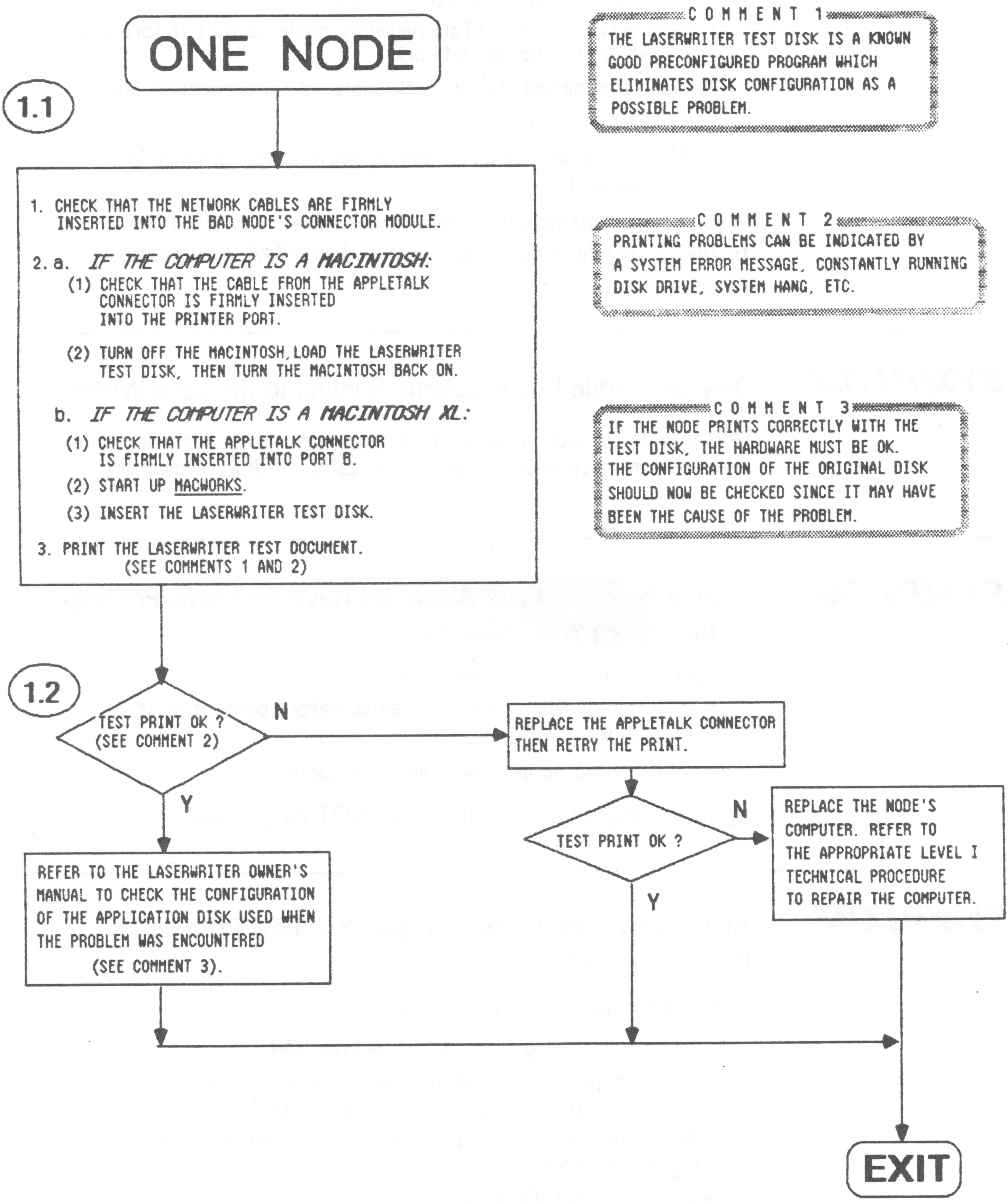
Go to the TWO OR MORE, BUT NOT ALL flowchart.

SYMPTOM: All Nodes on the Network Have Problems Printing to the LaserWriter.

This problem condition is usually a result of:

* A malfunctioning LaserWriter printer OR
* An Improperly terminated network cable (broken or not terminated into a connection box) OR
* A malfunctioning node putting electronic noise on the AppleTalk network cable.

Go to the ALL NODES flowchart.


ONE NODE
1.1
1. CHECK THAT THE NETWORK CABLES ARE FIRMLY INSERTED INTO THE BAD NODE'S CONNECTOR MODULE.
2. a. IF THE COMPUTER IS A MACINTOSH:
(1) CHECK THAT THE CABLE FROM THE APPLETALK CONNECTOR IS FIRMLY INSERTED INTO THE PRINTER PORT.
(2) TURN OFF THE MACINTOSH, LOAD THE LASERWRITER TEST DISK, THEN TURN THE MACINTOSH BACK ON.
b. IF THE COMPUTER IS A MACINTOSH XL:
(1) CHECK THAT THE APPLETALK CONNECTOR IS FIRMLY INSERTED INTO PORT B.
(2) START UP MACWORKS.
(3) INSERT THE LASERWRITER TEST DISK.
3. PRINT THE LASERWRITER TEST DOCUMENT. (SEE COMMENTS 1 AND 2)
COMMENT 1
THE LASERWRITER TEST DISK IS A KNOWN GOOD PRECONFIGURED PROGRAM WHICH ELIMINATES DISK CONFIGURATION AS A POSSIBLE PROBLEM.
COMMENT 2
PRINTING PROBLEMS CAN BE INDICATED BY A SYSTEM ERROR MESSAGE, CONSTANTLY RUNNING DISK DRIVE, SYSTEM HANG, ETC.
COMMENT 3
IF THE NODE PRINTS CORRECTLY WITH THE TEST DISK, THE HARDWARE MUST BE OK. THE CONFIGURATION OF THE ORIGINAL DISK SHOULD NOW BE CHECKED SINCE IT MAY HAVE BEEN THE CAUSE OF THE PROBLEM.
1.2
TEST PRINT OK ? (SEE COMMENT 2)
N
Y
REPLACE THE APPLETALK CONNECTOR THEN RETRY THE PRINT.
TEST PRINT OK ?
N
Y
REPLACE THE NODE'S COMPUTER. REFER TO THE APPROPRIATE LEVEL I TECHNICAL PROCEDURE TO REPAIR THE COMPUTER.
REFER TO THE LASERWRITER OWNER'S MANUAL TO CHECK THE CONFIGURATION OF THE APPLICATION DISK USED WHEN THE PROBLEM WAS ENCOUNTERED (SEE COMMENT 3).
EXIT

Explanation for the ONE NODE Flowchart

(1.1) This procedure should be performed if only one user node has problems printing to the LaserWriter.

The first step is to make sure that the AppleTalk connector is inserted into the correct socket for the type of computer used.

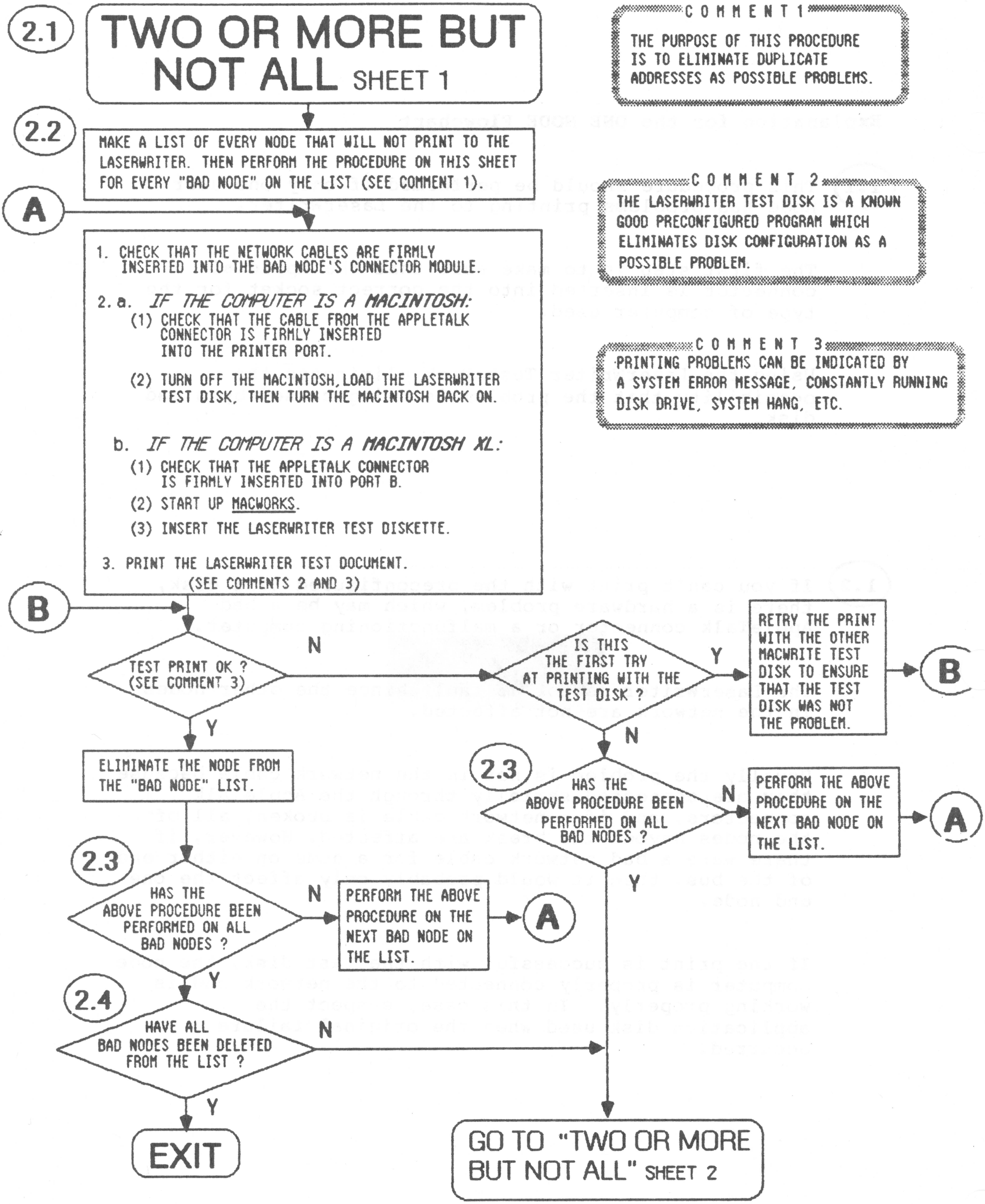
Using the LaserWriter Test Disk eliminates the possibility that the problem is being caused by a bad disk.

(1.2) If you can't print with the preconfigured test disk, there is a hardware problem, which may be a bad AppleTalk connector or a malfunctioning computer.

The LaserWriter is not at fault since the other nodes in the network are not affected.

Usually the problem is not in the network cable because they are connected serially through the AppleTalk connectors, and if a network cable is broken, all of the nodes beyond the break are affected. However, if there were a bad network cable for a node on either end of the bus, then it would probably only affect the one end node.

If the print is successful with the test disk, the node computer is properly connected to the network and is working properly. In this case, suspect the application disk used when the original failure occurred.


2.1
TWO OR MORE BUT NOT ALL SHEET 1
COMMENT 1
THE PURPOSE OF THIS PROCEDURE IS TO ELIMINATE DUPLICATE ADDRESSES AS POSSIBLE PROBLEMS.
2.2
MAKE A LIST OF EVERY NODE THAT WILL NOT PRINT TO THE LASERWRITER. THEN PERFORM THE PROCEDURE ON THIS SHEET FOR EVERY "BAD NODE" ON THE LIST (SEE COMMENT 1).
COMMENT 2
THE LASERWRITER TEST DISK IS A KNOWN GOOD PRECONFIGURED PROGRAM WHICH ELIMINATES DISK CONFIGURATION AS A POSSIBLE PROBLEM.
A
1. CHECK THAT THE NETWORK CABLES ARE FIRMLY INSERTED INTO THE BAD NODE'S CONNECTOR MODULE.
2. a. IF THE COMPUTER IS A MACINTOSH:
(1) CHECK THAT THE CABLE FROM THE APPLETALK CONNECTOR IS FIRMLY INSERTED INTO THE PRINTER PORT.
(2) TURN OFF THE MACINTOSH, LOAD THE LASERWRITER TEST DISK, THEN TURN THE MACINTOSH BACK ON.
b. IF THE COMPUTER IS A MACINTOSH XL:
(1) CHECK THAT THE APPLETALK CONNECTOR IS FIRMLY INSERTED INTO PORT B.
(2) START UP MACWORKS.
(3) INSERT THE LASERWRITER TEST DISKETTE.
3. PRINT THE LASERWRITER TEST DOCUMENT. (SEE COMMENTS 2 AND 3)
COMMENT 3
PRINTING PROBLEMS CAN BE INDICATED BY A SYSTEM ERROR MESSAGE, CONSTANTLY RUNNING DISK DRIVE, SYSTEM HANG, ETC.
B
TEST PRINT OK ? (SEE COMMENT 3)
N
IS THIS THE FIRST TRY AT PRINTING WITH THE TEST DISK ?
Y
RETRY THE PRINT WITH THE OTHER MACWRITE TEST DISK TO ENSURE THAT THE TEST DISK WAS NOT THE PROBLEM.
B
Y
N
ELIMINATE THE NODE FROM THE "BAD NODE" LIST.
2.3
HAS THE ABOVE PROCEDURE BEEN PERFORMED ON ALL BAD NODES ?
N
PERFORM THE ABOVE PROCEDURE ON THE NEXT BAD NODE ON THE LIST.
A
Y
2.3
HAS THE ABOVE PROCEDURE BEEN PERFORMED ON ALL BAD NODES ?
N
PERFORM THE ABOVE PROCEDURE ON THE NEXT BAD NODE ON THE LIST.
A
Y
2.4
HAVE ALL BAD NODES BEEN DELETED FROM THE LIST ?
N
Y
EXIT
GO TO "TWO OR MORE BUT NOT ALL" SHEET 2

Explanation for the TWO OR MORE BUT NOT ALL Flowchart

(2.1) This procedure should be performed if more than one, but not all, of the nodes are having problems printing to the LaserWriter.

The most probable cause of this type of problem is duplicate addresses or a dangling/broken network cable.

A disk configuration problem is not likely since more than one node is involved. In any event, by using the LaserWriter Test Disk to perform the test print, you eliminate the possibility of a bad disk.

Nor can the problem be with the LaserWriter because if it were, then all the nodes would be affected.

(2.2) Whenever a node starts up on the network, it assigns itself an address number so other nodes will have a means of directing messages to it.

Before a node can assign itself an address number, it must check to make sure there is no other node on the network with the same address.

To do this, the node transmits an inquiry message onto the network, containing the address the node wants to use for itself.

If there is another node on the network with that address, the other node will respond to the inquiry.

(Continued on the next page).

2.2 (continued)

If the original node receives a response, it will select another address to test. This will go on until the node finds an address that is not being used by any other node on the network.

When the node finds an unused address it will claim that address as its own until it is taken off the network. When the node is started up again it will repeat the above process to find a usable address.

Once a node has obtained an address on the network, it will compare it to the address in every message that is sent by the other nodes on the network.

When the node recognizes its own address, it will read the message attached to the address.

Starting up a node while it is not connected to the network and then connecting it afterwards can cause redundant addresses. This is because if a node is not connected to the network when started up, then the rest of the nodes cannot respond to its address inquiry.

In the case described above, the node will always assume the first address it tests is OK. Yet another node on the network may be using that same address.

(Continued on the next page).

2.2 (continued)

When two nodes have the same address, both will respond when the address is used. Since no more than one node can be transmitting on the network at a time, these responses collide and are unintelligible, much the same as when two people are speaking at the same time.

Starting up each bad node while it is connected to the network will cause it to perform a proper address inquiry, thereby eliminating possible duplicate addresses.

2.3 Duplicate addresses or a dangling/broken network cable are the most common reasons for performing the "TWO OR MORE BUT NOT ALL" flowchart.

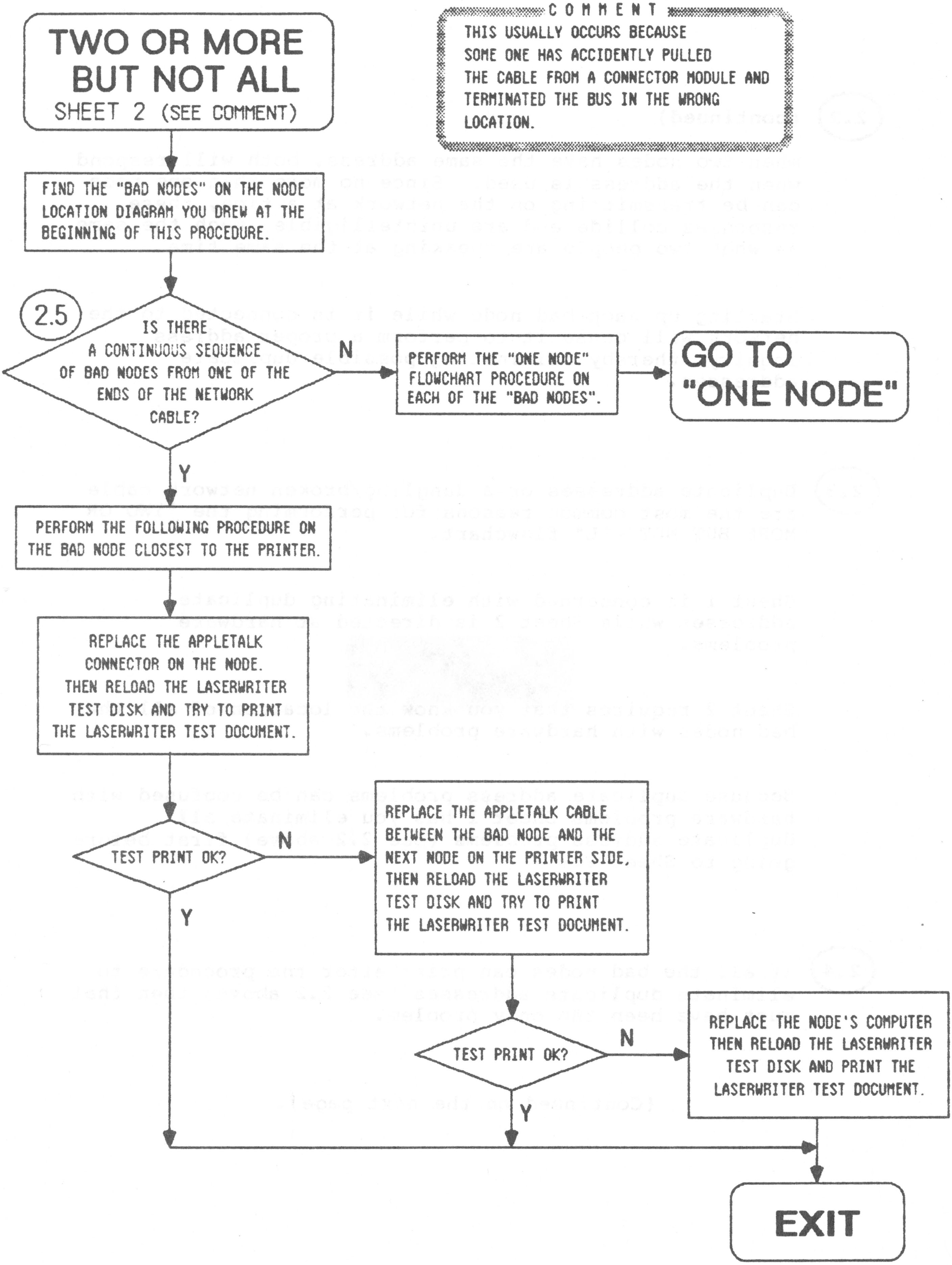
Sheet 1 is concerned with eliminating duplicate addresses while Sheet 2 is directed at hardware problems.

Sheet 2 requires that you know the location of all the bad nodes with hardware problems.

Because duplicate address problems can be confused with hardware problems Sheet 1 has you eliminate **all** duplicate address problems (see 2.2 above) first before going to Sheet 2.

2.4 If all the bad nodes can print after the procedure to eliminate duplicate addresses (see 2.2 above) then that must have been the only problem.

(Continued on the next page).


TWO OR MORE BUT NOT ALL
SHEET 2 (SEE COMMENT)
COMMENT
THIS USUALLY OCCURS BECAUSE SOME ONE HAS ACCIDENTLY PULLED THE CABLE FROM A CONNECTOR MODULE AND TERMINATED THE BUS IN THE WRONG LOCATION.
FIND THE "BAD NODES" ON THE NODE LOCATION DIAGRAM YOU DREW AT THE BEGINNING OF THIS PROCEDURE.
2.5
IS THERE A CONTINUOUS SEQUENCE OF BAD NODES FROM ONE OF THE ENDS OF THE NETWORK CABLE?
N
PERFORM THE "ONE NODE" FLOWCHART PROCEDURE ON EACH OF THE "BAD NODES".
GO TO "ONE NODE"
Y
PERFORM THE FOLLOWING PROCEDURE ON THE BAD NODE CLOSEST TO THE PRINTER.
REPLACE THE APPLETALK CONNECTOR ON THE NODE. THEN RELOAD THE LASERWRITER TEST DISK AND TRY TO PRINT THE LASERWRITER TEST DOCUMENT.
TEST PRINT OK?
N
Y
REPLACE THE APPLETALK CABLE BETWEEN THE BAD NODE AND THE NEXT NODE ON THE PRINTER SIDE, THEN RELOAD THE LASERWRITER TEST DISK AND TRY TO PRINT THE LASERWRITER TEST DOCUMENT.
TEST PRINT OK?
N
Y
REPLACE THE NODE'S COMPUTER THEN RELOAD THE LASERWRITER TEST DISK AND PRINT THE LASERWRITER TEST DOCUMENT.
EXIT

Explanation for the TWO OR MORE BUT NOT ALL Flowchart

(2.5) Since the network cables are connected serially through the AppleTalk connectors, if a network cable is broken, all of the nodes beyond the break will be affected.

The idea at this point is to determine whether the nodes are bad due to a broken or dangling network cable, or due to node specific problems that are unrelated to each other.

If there is a broken or dangling cable, then the bad nodes will be located in sequence from one end of the network bus. The "TWO OR MORE BUT NOT ALL" flowchart procedure checks each hardware component that could be causing this kind of problem.

If the bad nodes are not in sequence, their problems are probably unrelated. By performing the "ONE NODE" flowchart procedure on each bad node, you check each hardware component that could be causing this type of problem.

ALL NODES

SHEET 1

3.1

1. TURN OFF THE LASERWRITER, THEN TURN IT ON AND *WAIT* FOR A TEST PRINT.
2. COMPARE THE TEST PRINT WITH FIGURE 1 ON THE OPPOSITE PAGE.
3. CONFIRM THAT THE PRINTOUT IS CLEAR AND THAT THE "COMMUNICATIONS INDICATOR" IS "APPLETALK" AS SHOWN IN THE DIAGRAM. (SEE COMMENT 1)

3.2

TEST PRINT OK?

N → GO TO THE "LASERWRITER TROUBLESHOOTING PROCEDURE".

Y ↓

STEPS 1 AND 2 ISOLATE THE LASERWRITER AND ONE NODE FROM THE REST OF THE NETWORK (SEE COMMENT 2).

1. IF THERE ARE NODES CONNECTED TO BOTH SIDES OF THE PRINTER, THEN GO TO THE PRINTER; DISCONNECT THE NODES ON ONE SIDE AND LEAVE THE OTHER SIDE CONNECTED.
2. FIND THE FIRST NODE NOW CONNECTED TO THE PRINTER. FIND THE NODE'S APPLETALK CONNECTOR. UNPLUG THE NETWORK CABLE FROM THE NODE'S APPLETALK CONNECTOR WHICH LEADS AWAY FROM THE PRINTER. LEAVE THE CABLE GOING TO THE PRINTER CONNECTED (SEE FIGURE 2 ON PAGE 21).
3. CHECK THAT THE NETWORK CABLE PLUG IS FIRMLY INSERTED INTO THE NODE'S CONNECTOR MODULE.
4. a. *IF THE COMPUTER IS A MACINTOSH:*
   (1) CHECK THAT THE CABLE FROM THE APPLETALK CONNECTOR IS FIRMLY INSERTED INTO THE PRINTER PORT.
   (2) TURN OFF THE MACINTOSH, LOAD THE LASERWRITER TEST DISK, THEN TURN THE MACINTOSH BACK ON.

   b. *IF THE COMPUTER IS A MACINTOSH XL:*
   (1) CHECK THAT THE APPLETALK CONNECTOR IS FIRMLY INSERTED INTO PORT B.
   (2) START UP MACWORKS.
   (3) INSERT THE LASERWRITER TEST DISK.
3. PRINT THE LASERWRITER TEST DOCUMENT FROM THE TEST DISK (SEE COMMENTS 3 AND 4).

3.3

TEST PRINT OK ? (SEE COMMENT 4)

N → RETRY THE PRINT WITH THE OTHER LASERWRITER TEST DISK TO ENSURE THAT THE TEST DISK WAS NOT THE CAUSE OF THE PROBLEM. → GO TO "FIRST NODE"

Y → GO TO "ALL NODES" SHEET 2

COMMENT 1

IF THE PRINTER IS DOWN, THE WHOLE NET WILL APPEAR TO BE MALFUNCTIONING. A PRINT FUNCTION PROBLEM MIGHT CAUSE THIS SYMPTOM. THIS STEP IS MEANT TO PROVE WHETHER OR NOT THE PRINT FUNCTIONS ON THE PRINTER ARE OK.

COMMENT 2

BY DISCONNECTING THE REST OF THE BUS FROM THE NODE CLOSEST TO THE PRINTER, YOU ELIMINATE ANY EFFECTS A FAULTY BUS MIGHT HAVE ON COMMUNICATIONS BETWEEN THE FIRST NODE AND THE PRINTER.

IF YOU CAN NOW PRINT FROM THE FIRST NODE, THE PRINTER'S COMMUNICATIONS FUNCTION MUST BE OK.

COMMENT 3

THE LASERWRITER TEST DISK IS A KNOWN GOOD PRECONFIGURED PROGRAM WHICH ELIMINATES DISK CONFIGURATION AS A POSSIBLE PROBLEM.

COMMENT 4

PRINTING PROBLEMS CAN BE INDICATED BY A SYSTEM ERROR MESSAGE, CONSTANTLY RUNNING DISK DRIVE, SYSTEM HANG, ETC.

Explanation for the ALL NODES Flowchart

(3.1) Problems which cause all nodes on the network to malfunction include:

* A LaserWriter malfunction.

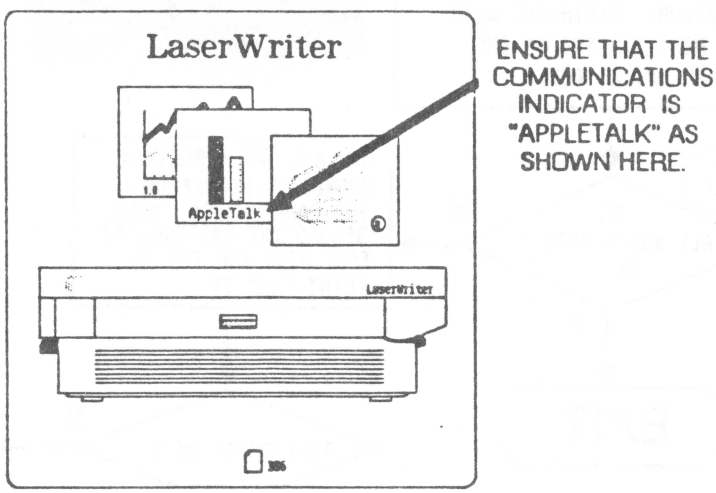
* A communications problem between the LaserWriter and the closest node.

* A network bus problem common to all nodes on the network.

The ALL NODES flowchart is concerned with isolating the problem to one of the three possibilities above.

(3.2) The print functions of the LaserWriter are those electromechanical operations that must be performed in order for a print to occur. Every time the LaserWriter is turned on, it will produce a test print to test these functions. If the printout is clear, then the hardware which performs the print functions is operating correctly.

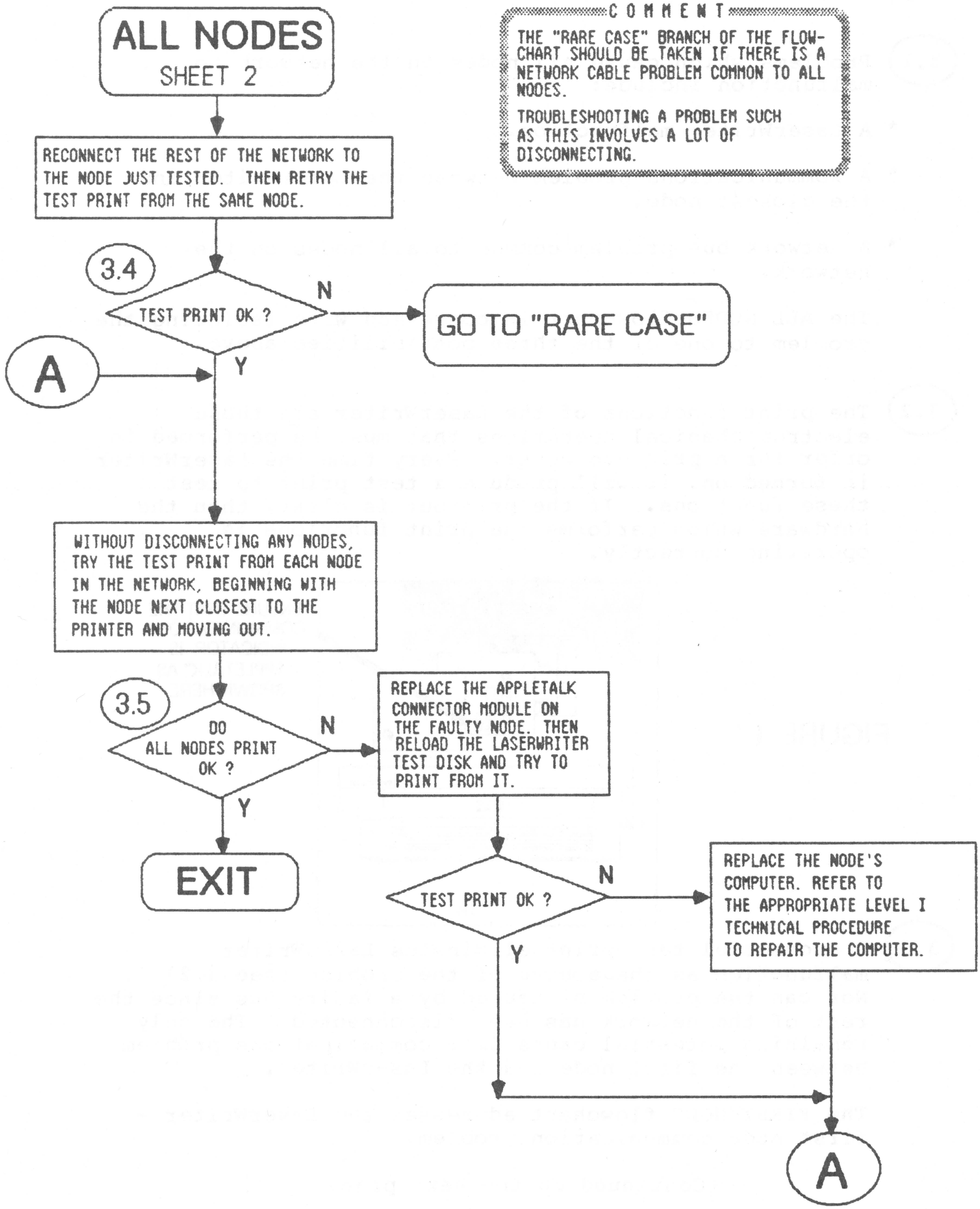
FIGURE 1



(3.3) A successful test print eliminates LaserWriter malfunction as the source of the problem (see 3.2). Nor can the problem be caused by a faulty bus since the rest of the network has been disconnected. The only remaining potential cause is a communications problem between the first node and the LaserWriter.

The FIRST NODE flowchart addresses the LaserWriter - first node communication problem.

(Continued on the next page).


ALL NODES
SHEET 2
COMMENT
THE "RARE CASE" BRANCH OF THE FLOW-CHART SHOULD BE TAKEN IF THERE IS A NETWORK CABLE PROBLEM COMMON TO ALL NODES.
TROUBLESHOOTING A PROBLEM SUCH AS THIS INVOLVES A LOT OF DISCONNECTING.
RECONNECT THE REST OF THE NETWORK TO THE NODE JUST TESTED. THEN RETRY THE TEST PRINT FROM THE SAME NODE.
3.4
TEST PRINT OK ?
N
GO TO "RARE CASE"
A
Y
WITHOUT DISCONNECTING ANY NODES, TRY THE TEST PRINT FROM EACH NODE IN THE NETWORK, BEGINNING WITH THE NODE NEXT CLOSEST TO THE PRINTER AND MOVING OUT.
3.5
DO ALL NODES PRINT OK ?
N
REPLACE THE APPLETALK CONNECTOR MODULE ON THE FAULTY NODE. THEN RELOAD THE LASERWRITER TEST DISK AND TRY TO PRINT FROM IT.
Y
EXIT
TEST PRINT OK ?
N
REPLACE THE NODE'S COMPUTER. REFER TO THE APPROPRIATE LEVEL I TECHNICAL PROCEDURE TO REPAIR THE COMPUTER.
Y
A

3.4 If a node works when isolated from the rest of the network but doesn't work when reconnected to the network, a network bus problem is indicated.

The RARE CASE flowchart addresses this situation.

3.5 At this point, you have proven that the print functions of the LaserWriter, the communications between the LaserWriter and the closest node, and the network cable bus all operate properly.

The rest of the ALL NODES flowchart is concerned with checking that the remainder of the nodes in the network operate correctly.

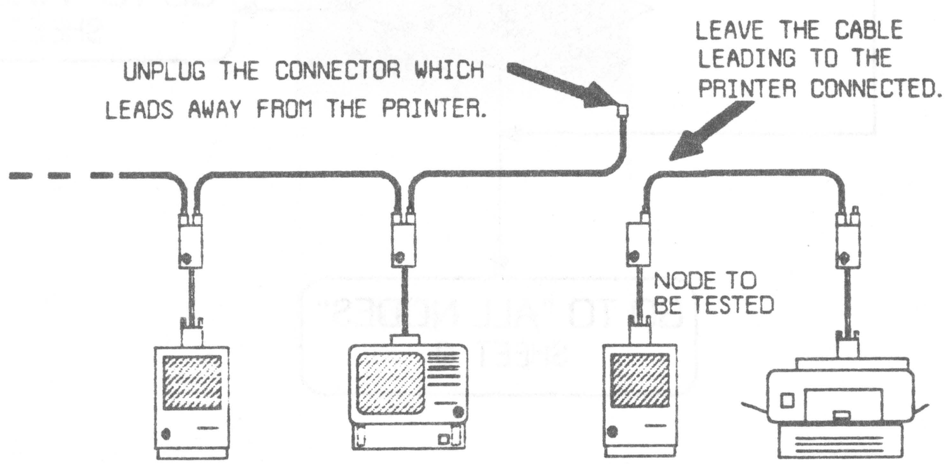
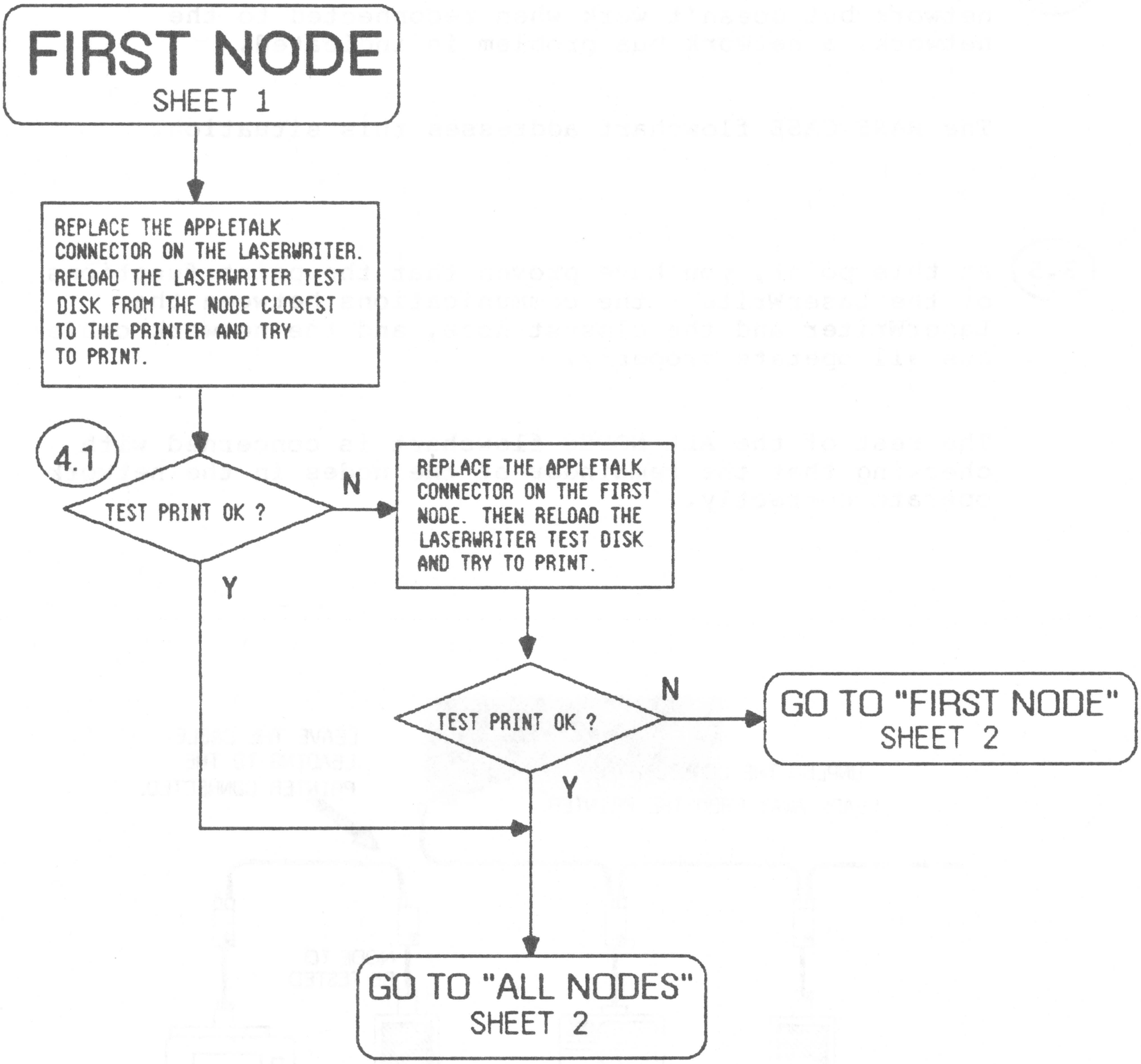


FIGURE 2

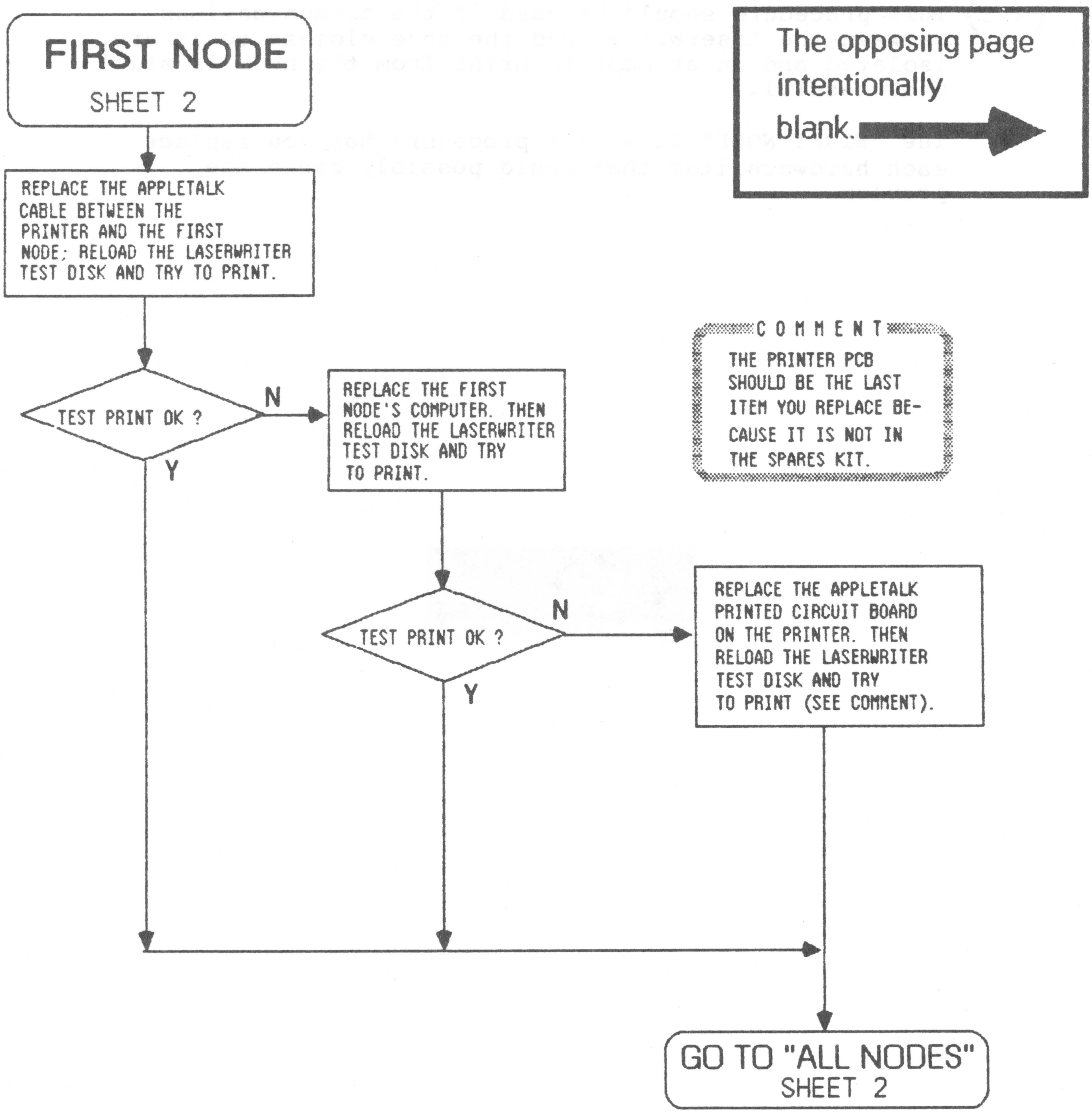
Figure 2 is referred to by Sheet 1 of the ALL NODES flowchart.


FIRST NODE
SHEET 1
REPLACE THE APPLETALK CONNECTOR ON THE LASERWRITER. RELOAD THE LASERWRITER TEST DISK FROM THE NODE CLOSEST TO THE PRINTER AND TRY TO PRINT.
4.1
TEST PRINT OK ?
N
Y
REPLACE THE APPLETALK CONNECTOR ON THE FIRST NODE. THEN RELOAD THE LASERWRITER TEST DISK AND TRY TO PRINT.
TEST PRINT OK ?
N
Y
GO TO "FIRST NODE"
SHEET 2
GO TO "ALL NODES"
SHEET 2

Explanation for the FIRST NODE Flowchart

(4.1) This procedure should be used if the communications between the LaserWriter and the node closest to it are isolated and an attempt to print from the node is still unsuccessful.

The "FIRST NODE" flowchart procedure has you replace each hardware item that could possibly cause the problem.

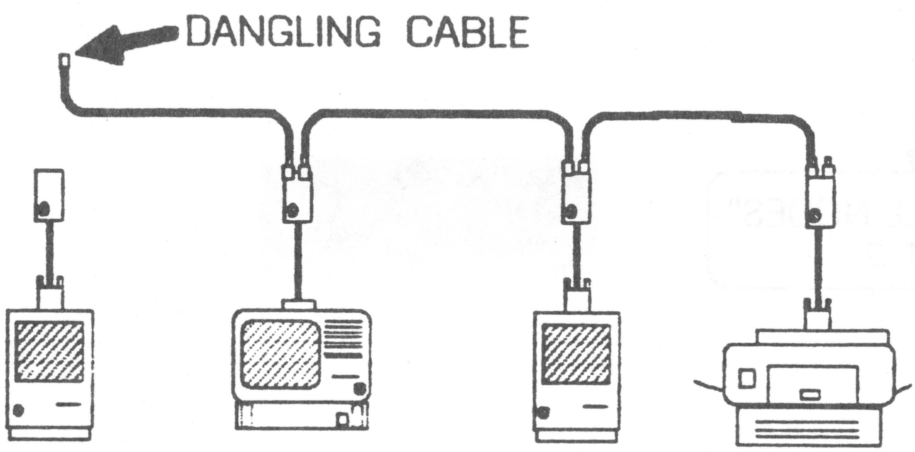

FIRST NODE
SHEET 2
The opposing page intentionally blank.
REPLACE THE APPLETALK CABLE BETWEEN THE PRINTER AND THE FIRST NODE; RELOAD THE LASERWRITER TEST DISK AND TRY TO PRINT.
TEST PRINT OK ?
N
Y
REPLACE THE FIRST NODE'S COMPUTER. THEN RELOAD THE LASERWRITER TEST DISK AND TRY TO PRINT.
COMMENT
THE PRINTER PCB SHOULD BE THE LAST ITEM YOU REPLACE BE- CAUSE IT IS NOT IN THE SPARES KIT.
TEST PRINT OK ?
N
Y
REPLACE THE APPLETALK PRINTED CIRCUIT BOARD ON THE PRINTER. THEN RELOAD THE LASERWRITER TEST DISK AND TRY TO PRINT (SEE COMMENT).
GO TO "ALL NODES"
SHEET 2

Explanation for the RARE CASE Flowchart

(5.1) This procedure should be performed if the communications between the LaserWriter and the node closest to it worked correctly when isolated, but a test print failed when the network bus was reconnected, indicating a bad network bus.

(5.2) There are two problems which result in a bad network bus:

(1) An improperly terminated (dangling or broken) network cable anywhere on the bus. For example, a network cable which has been accidently disconnected from its AppleTalk connection box (the dangling cable below) could result in an unbalanced impedance which could cause the whole bus to fail.

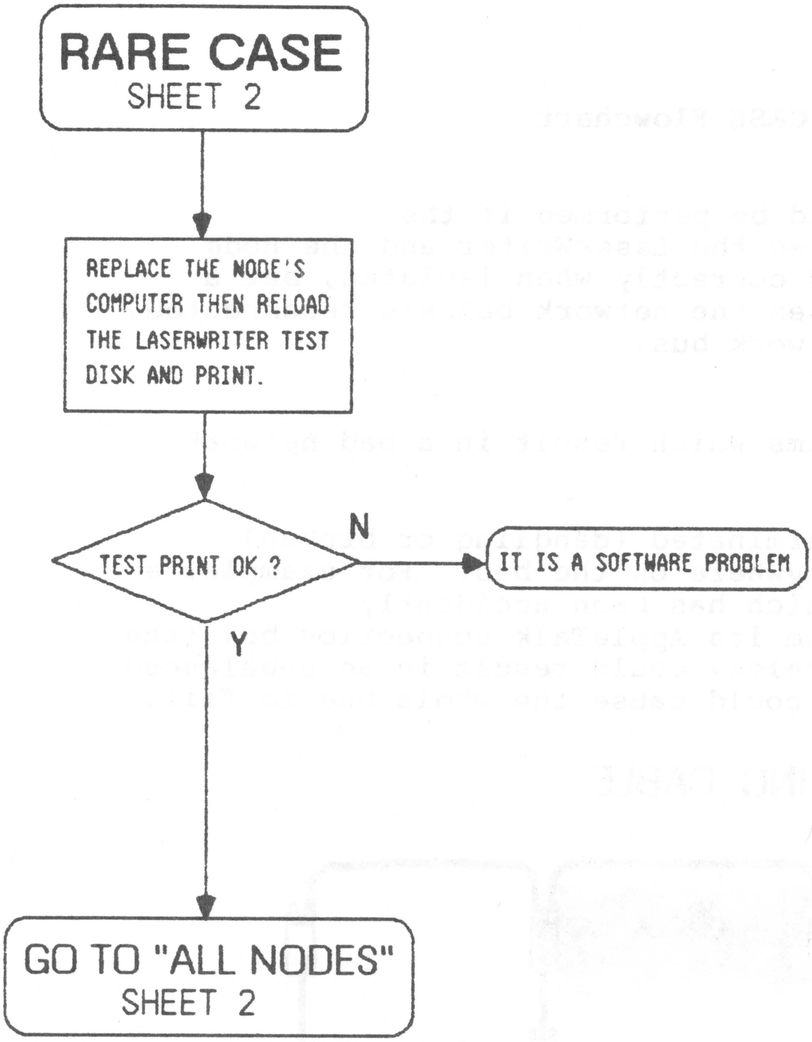


A broken network cable could cause the same problem.

(2) A malfunctioning node that puts a constant level of electric noise on the network bus. In this case no other node would try to transmit because the system appears "busy".

NOTE: For more information on noisy node problems and bus termination problems (i.e. dangling cables and circular networks) refer to the Appendix.

(Continued on the next page).


RARE CASE
SHEET 2
REPLACE THE NODE'S COMPUTER THEN RELOAD THE LASERWRITER TEST DISK AND PRINT.
TEST PRINT OK ?
N
IT IS A SOFTWARE PROBLEM
Y
GO TO "ALL NODES"
SHEET 2

5.2 Two problems which result in a bad network bus: (continued)

For Sheet 1 of RARE CASE, each node in the network is tested sequentially, beginning with the node closest to the LaserWriter.

As each node is being tested, it is connected to the nodes that have proven that they can print. The known good nodes and the node being tested are disconnected from the rest of the network.

When the node causing the network bus problem is connected, the test print will fail.

Once the bad node is found, the flowchart procedure checks each of the hardware components between the bad node and the nearest known good node.

MACINTOSH OFFICE (APPLETALK)
TECHNICAL PROCEDURES

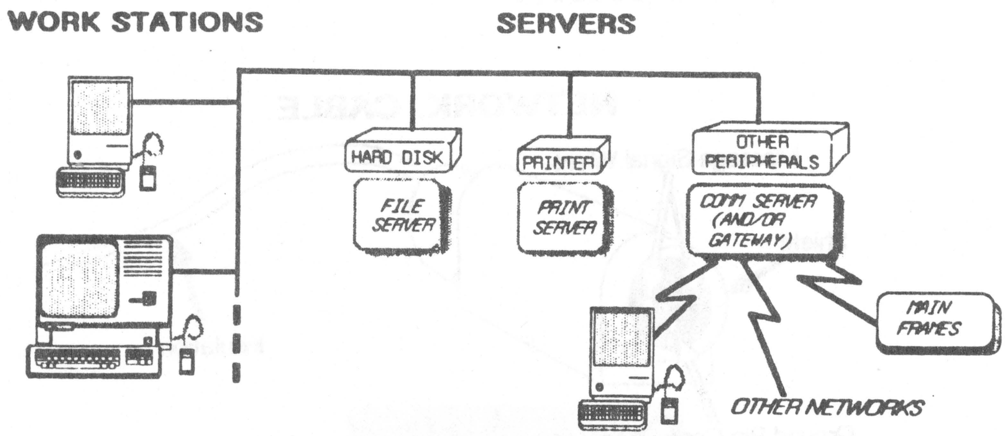
APPENDIX

TABLE OF CONTENTS

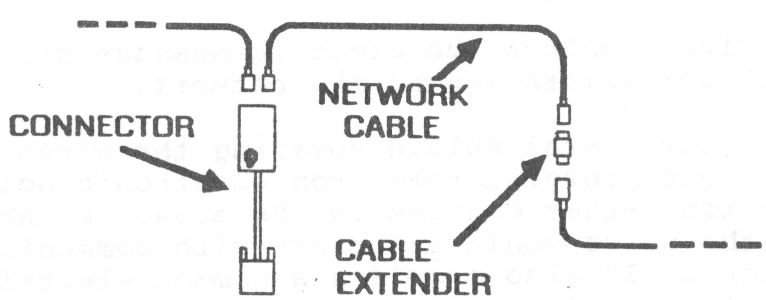
Contents:

WHAT IS THE APPLETALK PERSONAL NETWORK?

The AppleTalk Personal Network allows any Macintosh, or Macintosh XL user to share the use of a single LaserWriter Printer. In the future, other devices such as **file servers** (large capacity disk drives) and **communication servers** (devices that provide access to other computer networks) will be added to the network (shown below). Macintosh, and Macintosh XL users will also be able to communicate instantaneously with each other over the network when the appropriate software becomes available.



The AppleTalk Personal Network has three physical components: the **network cable**, the **AppleTalk connector**, and the **cable extender**, (shown below).



The AppleTalk connector is attached to a computer or other device; the individual AppleTalk connectors are then linked by means of the network cables. When all of the lengths of network cable are connected, they form a **network bus.**

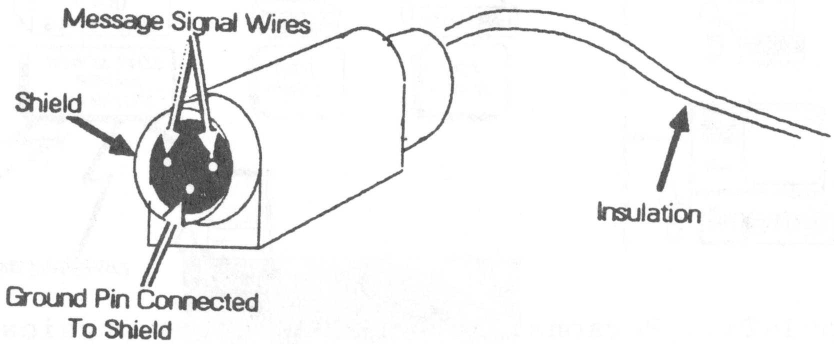
Each device location on an AppleTalk network is called a **node.** When we refer to a node, we mean the device itself and the AppleTalk connector attached to it.

The AppleTalk Components

AppleTalk Network Cable is sold in two and ten meter lengths with preassembled connector plugs. It is also sold in kit form for custom installations. The kit contains a one hundred meter spool of cable with unassembled connector plugs. The installer cuts the length of cable needed and then attaches a plug to each end.

The network cable is made up of two wires wrapped in a metal shield, which is then wrapped in electric insulation (shown below).

NETWORK CABLE



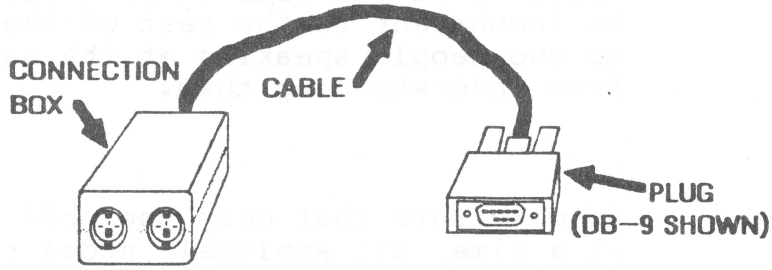
The two wires conduct the electric message signal to the AppleTalk connectors around the network.

The conductive metal shield covering the wires in the network cable protects them from electronic noise that may come from other devices in the area. Without the shield, the noise would interfere with communications on the network. It also provides a common electrical ground for all of the nodes.

The third pin on the network cable plug connects the cable shield (the network ground) through each AppleTalk connector to the ground lines of the attached devices.

An AppleTalk Connector is composed of a **plug** that fits into the back of the computer, a **cable** leading from the computer to the network, and a **connection box** (see the illustration below).

APPLETALK CONNECTOR



The **AppleTalk connector cable** permanently attaches the plug to the connection box. The plug for the Macintosh is a 9 pin DB type connector. For the Macintosh XL, the plug is a standard DB-25 connector.

The **connection box** provides the node with a connection point onto the network. The connection box has electronic components inside and two sockets for network cable plugs.

The sockets on the connection box are interchangeable. It makes no difference which one a network cable is plugged into.

An AppleTalk Cable Extender is a small double ended connector that allows two pieces of network cable to be joined together to form a longer cable. A cable extender should <u>not</u> be used to terminate the cable.

WHY NOISY NODES CAN CAUSE NETWORK BUS PROBLEMS

Only one node may transmit (put message signals on the network cable) at a time. If two nodes were allowed to transmit at the same time, their signals would collide and be incoherent to the rest of the network. This is similar to two people speaking at the same time preventing anyone from understanding them.

To make sure that only one node is transmitting on the bus at a time, all AppleTalk nodes follow a set of rules called Carrier Sense, Multiple Access with Collision Avoidance (CSMA/CA).

Carrier Sense means that before a node can transmit anything on the network, it will check the network cable to see if another node is transmitting. If there is, the node that is trying to transmit will wait for a designated period of time and then listen again; if the network is still busy, it will wait again, and so on. This will go on until the node detects that the bus is idle (no node is transmitting on the network). At this time the node will wait for a period of time to make sure that no other node is going to transmit and then begin its own transmission (see collision avoidance below).

Multiple Access means that every node has equal access to the network cable through its connection box.

Collision Avoidance means that AppleTalk tries to minimize collisions by having each node wait a different amount of time after the bus becomes idle before they transmit.

If the interface electronics in a node failed and put electric noise on the bus, the other nodes might sense the noise and assume that the bus was always busy. If this were to happen the other nodes would never transmit any messages.

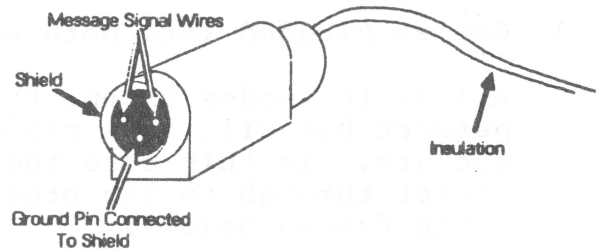
APPLETALK BUS TERMINATION PROBLEMS

The Circuit on the AppleTalk Network Cable

NOTE: For the following explanations, many of the terms and concepts have been simplified.

The network cable is made up of two message signal wires wrapped in a metal shield, which is then wrapped in electric insulation (shown below).

NETWORK CABLE



The two wires carry the message signals around the network.

The message signals have a maximum **frequency** of 230.4 KHz. That means that a transition from the most positive to the most negative voltage levels of the signal can happen up to 230.4 thousand times a second.

There is an electronic component called a **transformer** in every connection box. Each node's transformer couples the node to the network bus. When a node transmits, it sends the message signal to the transformer which conveys it onto the message signal wires of the network cable. The transformers in the other node's connection boxes allow them to read the message signal from the bus.

The message signal is put on the network cable in a differential fashion. That means that at any given time if the message signal voltage on one of the wires is positive, then the other wire will be negative, and vice versa.

Since electric current is often thought of as flowing from negative to positive, we will call the negative wire the **source** wire and the positive wire the **return** wire.

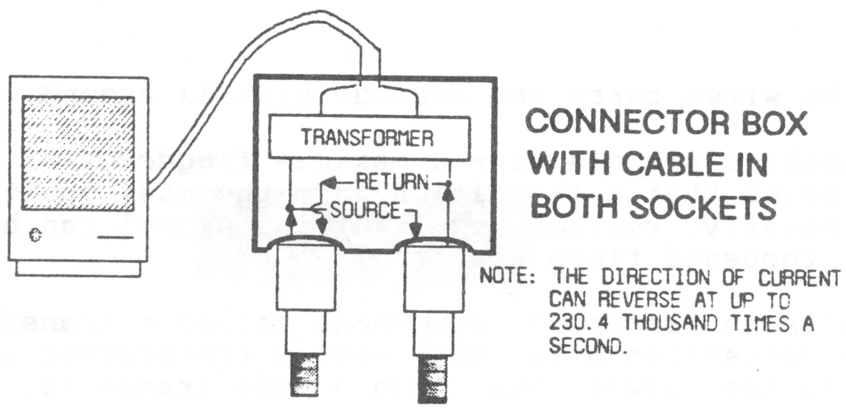
When the voltages change, the direction of current will change, thus the role of the wires alternate. However, at any given instant during a transmission, one wire will be the source and one the return.

NOTE: The AppleTalk bus conforms to the electrical interface specifications defined in the Electronic Industries Association's <u>RS-449/422 Standard</u>. For more detailed information on the RS-449/422 interface, refer to that document.

When a signal enters a connection box from a length of network cable, it will do one of two things depending on whether or not a network cable is plugged into the other socket.

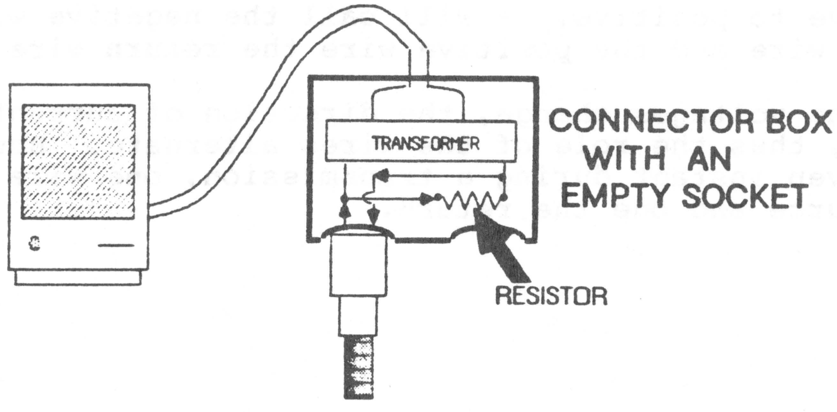
(1) **Cables plugged into both sockets.**

All of the nodes except those on the two ends of the network bus will have cables plugged into both sockets. In this case the signal flows from one socket through to the other into the next length of cable (shown below).



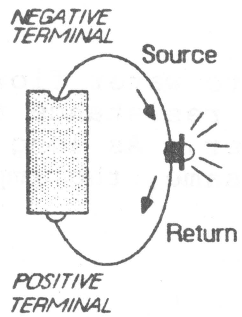
(2) **Cable plugged into only one socket.**

The end nodes will have a cable plugged into only one socket. Each connection box is designed so that if a socket is empty, a switch inside the box connects the signal wires from the other socket to a terminating resistor. The message signal current in the source wire flows through the terminating resistor back to the return wire completing the circuit (shown below).

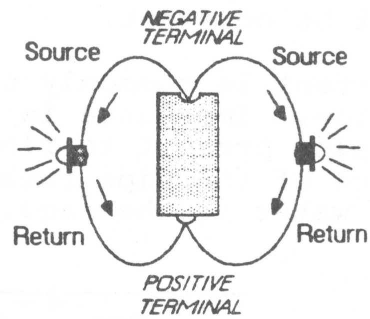


The AppleTalk Network Bus circuit is like the circuit in a flashlight.

FLASHLIGHT CIRCUIT WITH ONE BULB



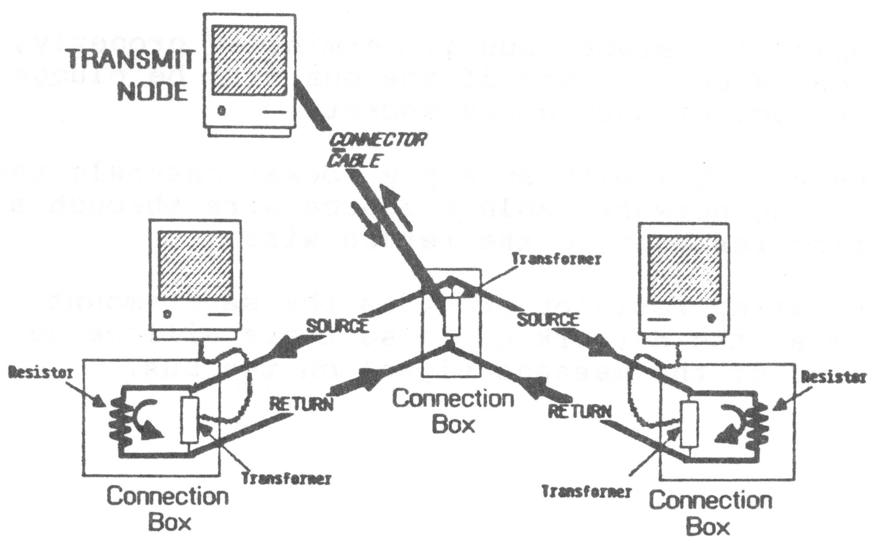
FLASHLIGHT CIRCUIT WITH TWO BULBS



The current from the source (negative) wire flows through something called a load (a bulb for the flashlight and a terminating resistor for the AppleTalk bus) to the return (positive) wire. In the flashlight example above, two bulbs are shown to demonstrate that the current can be split at its source to travel through two loads and arrive at the same return point. In the AppleTalk bus example below the same thing occurs. The only difference is that the current is going through two terminating resistors instead of two bulbs.

In the flashlight the battery provides the power, while in the AppleTalk bus the transmitting node provides the power in the form of the message signal.

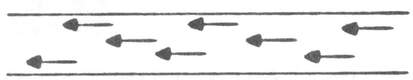
APPLETALK CIRCUIT



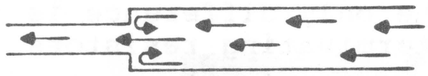
Impedance on the AppleTalk Network Cable

For the message signal current to flow smoothly and accurately, the impedance (explained below) throughout the network must be constant.

Electric current is commonly compared to water flowing through a pipe. Impedance is like the resistance that the walls of a pipe present to flowing water. As long as the circumference of the pipe remains the same, the impedance to the flow of water is the same.



If at some point the pipe's circumference is made smaller, the impedance to the flow will increase at that point and part of the water will be reflected back.



In an AppleTalk network the message signal current flows through the source message wire the way water flows through the pipe. It is important to avoid changes in impedance since that can cause reflections of the message signal similar to the reflections that occurred when the water encountered the narrower pipe.

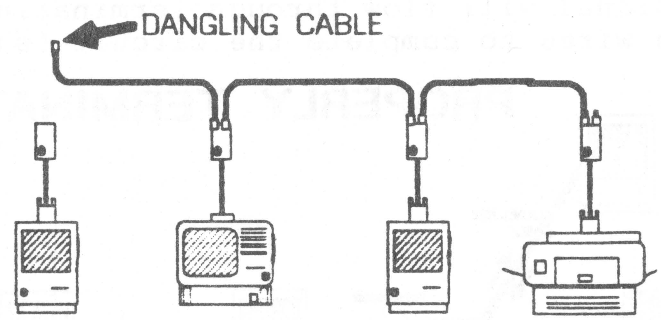
If an AppleTalk network bus is terminated properly, the network cable on each end of the bus will be plugged into a connection box with an empty socket.

The connection box with an empty socket channels the message signal on the network cable's source wire through a terminating resistor to the return wire.

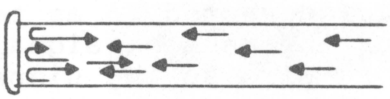
The terminating resistor provides the same amount of impedance as the network cable so there will be no reflections of the message signal on the bus.

Dangling Cables

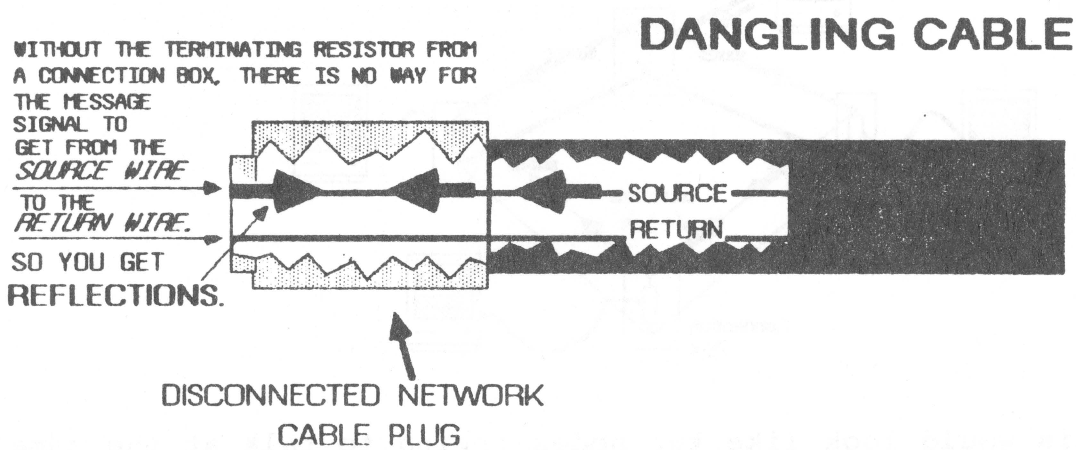
If a network cable is left dangling (shown below), when the current on the source wire reaches the unterminated end, it has no channel to take to the return wire.



The message signal in a dangling cable has no place to flow once it reaches the end of the cable so it is reflected back on to the source wire, just like a flow of water run into a capped pipe (shown below).



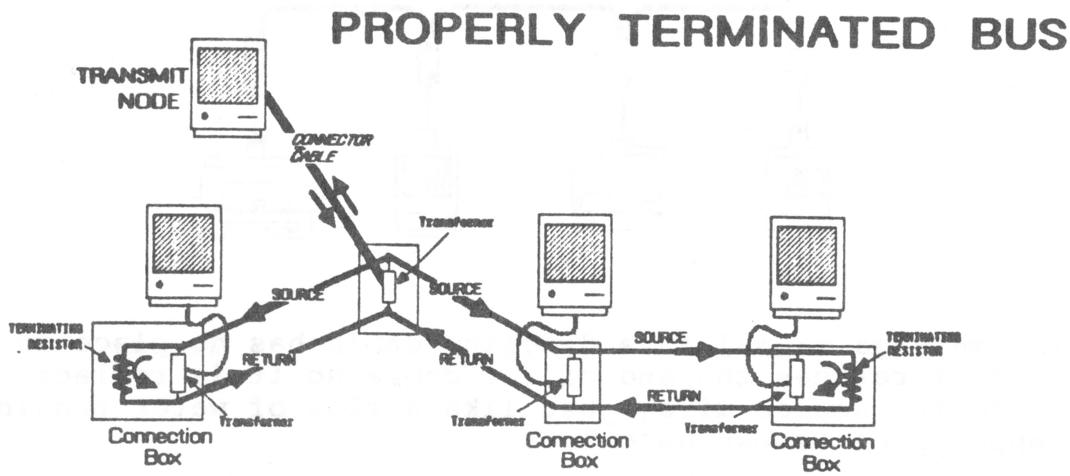
The reflections would bounce back along the source wire and mix with the original message signal (shown below). This would look like two nodes trying to talk at the same time, and that would interfere with communications.



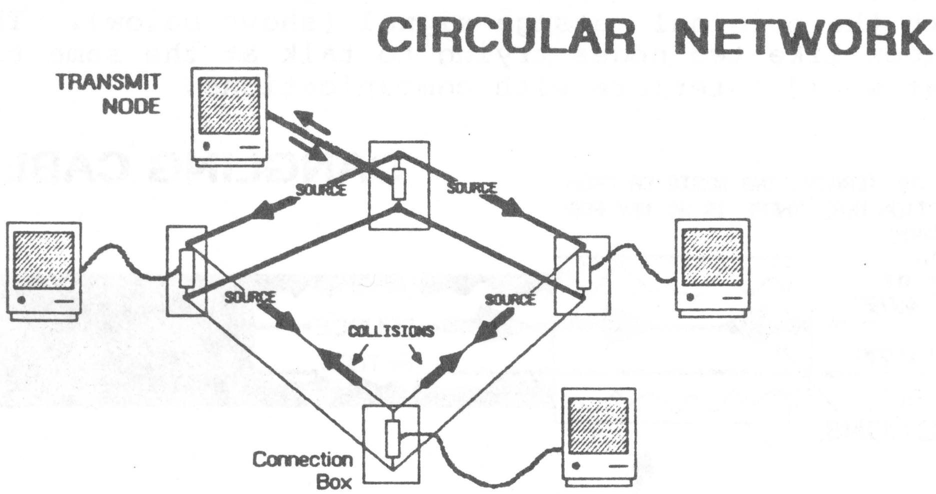
To prevent reflections of the message signal on the network, it is very important to always terminate the ends of the network cable into a connection box.

Circular Networks

When a signal is transmitted onto the network cable by a node somewhere in the center of a bus, the source signal is sent to both sides of the bus. If both ends are properly terminated (i.e. each end plugged into a connection box), the message signal will flow through terminating resistors to the return wires to complete the circuit (shown below).



If the network cables are connected so as to form a closed loop, there is no way for the message signal on the source wire to flow to the return wire so the signals on both sides of the bus will collide with each other (shown below).



This would look like two nodes trying to talk at the same time, and that would interfere with communications. Therefore, it is very important to always terminate the ends of the network cable into connection boxes so that it does not form a closed loop.

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